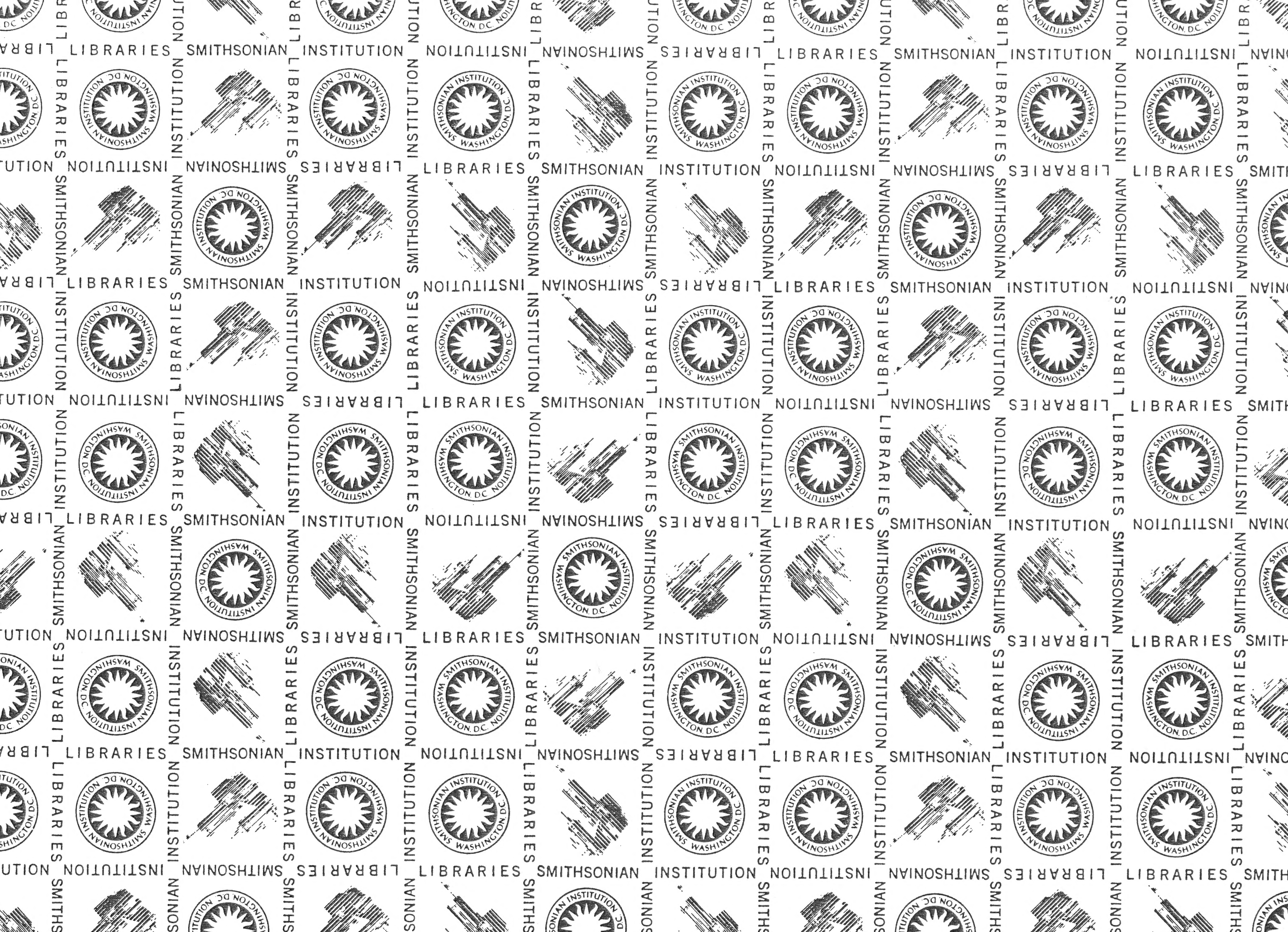
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AN ANNOTATED BIBLIOGRAPHY ON PREPARATION, TAXIDERMY, AND COLLECTION MANAGEMENT OF VERTEBRATES WITH EMPHASIS ON BIRDS

Stephen P. Rogers
Mary Ann Schmidt
Thomas Gütebier

CARNEGIE MUSEUM OF NATURAL HISTORY

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of CARNEGIE MUSEUM OF NATURAL HISTORY

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THE CARNEGIE
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PREFACE

The more knowledgeable one becomes in science, the more one realizes how much more there is to be learned. I have been preparing specimens of vertebrates for more than twenty years and I am still only a novice in the total scheme of things. To become a complete, well-rounded preparator, one must put in many decades of work, often apprenticing under a master. Unfortunately this rarely happens. An employment opportunity presents itself and the applicant asserts "I skin birds with the best of them." It then becomes an overwhelming on-the-job educational opportunity.

The conscientious preparator continually attempts to improve the quality and quantity of work. There are only a limited number of ways to do this. The best would be to visit a specialist in another institution; but with limited funding, this rarely happens. Next best would be to survey the literature on preparation. Quite a number of years ago I began assembling a bibliography and have yet to find an end to the methods one can discover to improve the techniques used in preparation.

With this publication, we have attempted to summarize most of the vertebrate preparation literature and related topics. The emphasis is on birds, though pertinent literature is covered for the other vertebrate groups. A large section is devoted to historical preparation because of my interest in this aspect and because these early works often contain "new" ideas we have long since forgotten. The majority of the titles are in English, though major works in other languages are covered. Many of the citations in these languages were contributed by colleagues from other countries who freely added to the preliminary bibliography which was circulated in June 1988. By far the greatest contribution was made by Thomas Gütebier of Malmö, Sweden, who responded to this initial plea for help; therefore he was asked to be third author and has annotated much of the foreign literature.

I would like to thank the following persons for their help in assembling this bibliography: Claude Weber, Muséum d'Histoire Naturelle, Genève, Switzerland; Carlo Violani, Università di Pavia, Italy; Jon Fjeldså and Harry Hjortaa, Universitetets Zoologiske Museum, København, Denmark; Aevar Petersen, Iceland Museum of Natural History, Reykjavik, Iceland; Dante Martins Teixeira, Universidade Federal do Rio de Janeiro, Brazil; Siegfried Eck, Staatliches Museum für Tierkunde, Dresden, Germany; Philippa Haarhoff, South African Museum, Capetown, South Africa; Clem Fisher, National Museums and Galleries on Merseyside, Liverpool, England; Walter E. Boles, The Australian Museum, Sydney, Australia; Richard Schodde, CSIRO, Australian National Wildlife Collection, Canberra, Australia; Shane Parker, South Australian Museum, Adelaide, Australia; Peter Lüps, Naturhistorisches Museum, Bern, Switzerland; John G. Williams, England; Pat Morris, Royal Holloway College, University of London, England; Ross James, Royal Ontario Museum, Toronto, Canada; James Dean, J. Phillip Angle, and Peter Cannell, National Museum of Natural History, Washington, DC; Robert W. Dickerman and George F. Barrowclough, The American Museum of Natural History, New York, New York; Joe Kish, Sheridan, Montana; Greg Septon and Floyd Easterman, Milwaukee Public Museum, Milwaukee, Wisconsin; and Stephen L. Williams, Catharine A. Hawks, Deborah E. Casselberry, Joan S. Gardner, Caroline Leckey, James M. Loughlin, C. J. McCoy, Kenneth C. Parkes, Christine Skelly, Elizabeth A. Walsh, and D. Scott Wood, The Carnegie Museum of Natural History, Pittsburgh, Pennsylvania. I also would like to thank the present and past staff of the Museum Library of The Carnegie Museum of Natural History, especially Elizabeth Kwater, Katalin Gyorgyey, Karen Mueller, Donna Beck, and Gerard McKiernan. Special thanks are extended to my wife and second author, without whom this bibliography would never have been initiated or completed.

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INTRODUCTION

The intent of this bibliography is to cover thoroughly the literature on bird preparation. Details of preparation techniques are often presented in large texts which do an adequate job of discussing most of the various aspects and methodologies used. However many of these individual works do not cover all aspects equally. As a result, the preparator must turn to a large number of major works to find the information sought. In cases when very detailed information is desired, these texts are inadequate since they are essentially composed of the author's own experiences plus those gleaned from the literature. It is for that reason this bibliography includes almost every citation that could be located, allowing the preparator to survey the complete literature and obtain the most detailed information desired.

Taxidermy is often considered a separate entity from scientific preparation of specimens. In larger American institutions these duties are usually performed by different personnel, since the end product and objectives are vastly different. However, many techniques for each discipline are similar and a preparator or taxidermist would benefit greatly by inter-disciplinary familiarization with the literature. Therefore both scientific preparation and taxidermy are covered thoroughly in this publication.

The organization of this bibliography is structured so that the preparator has reference to major texts and individual papers on specific topics. The Table of Contents lists 37 divisions or topics included herein. Major works are usually listed in the divisions that deal with all vertebrate groups (General Preparation of Vertebrates, Collection Management and Conservation, and General Taxidermy) or with specific vertebrate groups (Bird Preparation..., Bird Taxidermy, Mammal Preparation). The very specific topics (such as Washing, Degreasing, Relaxing, and Remaking of Skins; or Temporary Preservation) usually are composed of short papers or notes dealing with these individual topics. Certain divisions within this publication are devoted to other vertebrate groups because information used in preparation of these groups is often relevant to bird preparation. A large section addresses historical preparation as these references may document methods and materials used in the past which can be applicable to management of these specimens today.

At the beginning of each division is a short summary describing the information covered within the division. At the bottom of many divisions is a "See Also" list. This generally includes publications containing information pertinent to that topic but located in other divisions.

The preparation literature in languages other than English is treated differently. This portion is not as comprehensive as the English language literature but includes many of the major works for these languages. The complete citation and annotation appear in the last division, grouped together alphabetically by language. The author, date, and language of publication appear in the main text as a cross reference to the complete annotation. For additional citations, the user is referred to the works of Löwegren, 1961 (No. 078), and Piechocki, 1986 (No. 082), both of which include extensive bibliographies.

It is hoped that this annotated bibliography will be of use to preparators around the world enabling them to search out relevant literature and thus improve preparation standards. The authors hope that if a reader locates papers not contained within, they will contact us with further information on these publications.

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I. MUSEUMS AND COLLECTING

One major thrust of this division is to survey the various publications describing collections and the information which can be obtained from them. Particularly well written papers relevant to this area are those done by Barlow and Flood, 1983 (No. 004), Fjeldså, 1987 (No. 012), Parkes, 1963 (No. 032), and the volume edited by Miller, 1985 (No. 026).

A second theme within this division is to list those papers discussing the controversy of collecting versus not collecting new specimens. Both sides of the argument are covered, though more papers were found advocating the need to collect new specimens.

001 **Aldrich, J. W., R. C. Banks, T. J. Cade, W. A. Calder, F. G. Cooch, S. T. Emlen, G. A. Greenwell, T. R. Howell, J. P. Hubbard, D. W. Johnston, R. F. Johnston, and L. R. Mewaldt. 1975. Report of the American Ornithologists' Union *ad hoc* Committee on Scientific and Educational Use of Wild Birds. Supplement to Auk, 92(3). 27 pp.**

Includes justification for collecting and comparison of its impact on bird populations relative to other causes of death. Gives recommendations for collecting and capturing of birds. Also reviews regulations governing use of birds for scientific and educational purposes in the United States and Canada.

002 **Allen, F. G. H., P. Barclay-Smith, W. R. P. Bourne, B. Campbell, P. Conder, S. Cramp, P. R. Evans, I. J. Ferguson-Lees, J. Fisher, R. S. R. Fitter, P. A. D. Hollom, E. Hosking, R. Hudson, Hurcomb, J. Huxley, D. Lea, C. J. Mead, G. Mountfort, I. C. T. Nisbet, P. Scott, R. Spencer, A. Landsborough Thomson, J. A. Valverde, D. R. Wells, and K. Williamson. 1968. The collecting of rare birds. Ibis, 110:211-212.**

Valid arguments are given to urge that scientists refrain from collecting rare (in this case, endangered) birds, a now almost universal belief.

003 **Axtell, H. H. 1949. The bird study skin collection. Hobbies, 29(4):71-76.**

The author does an adequate job of covering many of the valuable contributions which study skin collections make to past, current, and future studies of birds. Also discusses the museum's collections' role as a regional headquarters for the public to use in the study of birds, similar to the reference shelves of a library.

004 **Barlow, J. C., and N. J. Flood. 1983. Research collections in ornithology -- a reaffirmation. Pp. 37-54, *in* Perspectives in Ornithology (A. H. Brush and G. A. Clark, Jr., eds.), Cambridge University Press, Cambridge, England. 560 pp.**

Excellent article discussing the past value of collections and also stressing the importance that new collections be made. Discusses the use of collections for identification, systematics, wildlife management, teaching, and general biology. Reiterates conclusions made by King and Bock in 1978 (No. 020).

005 **Breed, B. 1977. The case for collecting -- a critical look. South Australian Ornithological Association Newsletter, September issue, pp. 11-13.**

A superficially well-written argument against the need to collect birds, but few points stand up to critical examination (see Parker, 1977*b*, No. 031, and Brown, 1977, No. 006).

006 **Brown, R. F. 1977. In reference to collecting... South Australian Ornithological Association Newsletter, December issue, pp. 8-11.**

Strongly opposes the position Breed took when criticizing a previous list of books given by Brown to validate the need for collecting. Concentrates on a book by

David Lack pointing out the author's belief in collecting which is contrary to the interpretation by Breed, 1977 (No. 005).

007 **Bryant, J. M. 1983. Biological collections: legacy or liability? Curator, 26(3):203-218.**

Details the origin of world collections and traces the growth and changes in bird and mammal collections in this century. Portrays the future of biological collections as uncertain but suggests avenues for improvement.

008 **Chapman, F. M. 1907. What constitutes a museum collection of birds? Proceedings of the IV International Ornithological Congress, Ornis, 14:144-156.**

Good description of the purpose and value of museum collections of birds. Describes research and exhibit collections and how they are used by the public and by systematic ornithologists.

009 **Clancey, P. A. 1966. Some observations on collecting and the use of new techniques in systematic ornithology. South African Museums Association Bulletin, 8(9):297-300.**

Suggests a need to expand the collections of South Africa by collecting large series from one place at one time which is more valuable than collecting single individuals. Older collections are now "time expired" and require replacement. Stresses need for more mensural and chromatic data to support systematic work.

010 **Easterla, D. A. 1967. Values of collecting birds for scientific specimens. Bluebird, 34(2):10-12.**

Well written, even tempered article discussing many of the benefits to the science of ornithology of collecting study specimens of birds.

011 **Fisher, D. 1974. Specimens and the rare bird: a scientific viewpoint. Birding, 6:32-34.**

Stresses validity of collecting the accidental or stray bird often termed "rare" instead of preserving it as a photograph. "It would be absurd to argue that scientists on the moon should bring back only pictures of moon rocks rather than the actual rocks themselves."

012 **Fjeldså, J. 1987. Museum collections of birds -- relevance and strategies for the future. Acta Reg. Soc. Sci. Litt. Gothoburgensis, Zoologica, 14:223-228.**

Extremely well written paper using the available literature and recent surveys to point out the need for new collections in Scandinavia. Suggests that more museums should get involved and that they should develop well thought out plans to both sample and preserve specimens and tissues for the future.

013 **Foster, M. S. 1982. The research natural history museum: pertinent or passé. The Biologist, 64(1):1-12.**

Well-written description of the evolution, organization, and value of a research collection of biological specimens and how these collections will continue to be of value in the future.

014 **Grinnell, J. 1922. The museum conscience. Museum Work, 4:62-63.**

The purpose of this short essay was to emphasize that museum collections must be kept in precise order to facilitate their use and that utmost accuracy be used in conjunction with information about each specimen -- that curators develop the museum conscience.

015 **Hall, F. T. 1964. The museum and ornithology. Science on the March, 44:96-101.**

Short article discussing the origins of ornithology in the United States and detailing some of the contributions made by the Buffalo Museum of Science to this science and to the public in the way of exhibits.

016 **Howell, T. R. 1972. Some words on behalf of the scientific collector. Western Tanager, 38:1-2.**

Not seen. Citation from Aldrich *et al.*, 1975 (No. 001).

017 **James, R. D. 1983. On museum collecting. Toronto Field Naturalist Club Newsletter no. 353:7-10.**

A somewhat whimsical article arguing the insignificant effect of collecting on bird populations, and the value of bird collections. Suggests that perhaps we should not eat turkeys at Christmas, have windows in our houses, drive vehicles, keep cats, etc., all of which kill infinitely more birds in the long run than collecting.

018 **Johnels, A. G. 1973. Role of natural history museums. Museum, 25:54-59.**

Points out that long kept museum specimens may have a big impact for measuring the quality of life. The prime example used is mercury content of feathers, tracing levels in birds collected from 1815 to present. Comparisons also are made in wing feathers on the same recent bird, some of which grew in African wintering grounds and others in Sweden and show differing mercury levels. Suggests that the value of collections has only begun.

019 **Keast, A. 1973. The role of the museum in ornithology. Emu, 73:242-247.**

A well-written overview of the role of a curator in the museum and in society as a whole. Thoroughly details the history of collections in Australia and the need for further collecting and research to understand the ornithology of this portion of the world.

020 **King, J. R., and W. J. Bock. 1978. Workshop on a national plan for ornithology, final report. National Science Foundation/The Council of the American Ornithologists' Union, Washington, DC.**

A report on the current state of ornithology together with guidelines for the future. The bulk of the publication is composed of reports of six special panels: the role of the amateur and the society in ornithology; ornithological education; publications resources; special data banks; systematic collections; and obtaining and utilizing birds.

021 **Laubitz, D. R., C. T. Shih, and I. Sutherland. 1983. Why should a museum maintain a large collection? Pp. 169-171, in Proceedings of 1981 Workshop on Care and Maintenance of Natural History Collections (D. J. Faber, ed.), Syllogeus no. 44, National Museums of Canada, Ottawa, Canada. 196 pp.**

Outlines five basic reasons why museums should possess a large and varied collection: to allow sufficient material for scientific investigations; materials for display and education; reference collections; faunal assemblage collections; and voucher collections.

022 **Mayr, E. 1959. Trends in avian systematics. Ibis, 101(3-4):293-302.**

Gives a general overview of how the determination of avian systematics may proceed from that time period. Discusses new characters such as accompanying parasitic organisms, chemical methods such as protein or blood differences and egg white proteins. Also suggests that good old-fashioned comparative anatomy may be of great use.

023 **McGaugh, M. H., and H. H. Genoways. 1976. State laws as they pertain to scientific collecting permits. Museology, 2:1-81.**

Useful booklet (though now out of date) listing the regulations governing scientific collecting for each of the fifty states and Puerto Rico, obtained by contacting each of the agencies responsible for this activity. The short discussion section gives some interesting observations and good recommendations.

024 **McKitrick, M. C. 1981. Old specimens and new directions: a commentary. Auk, 98(1):196.**

Dispels the implied suggestion made by Ricklefs (1980, No. 037) that systematists have essentially finished their role in the taxonomy of birds.

025 **Miller, A. H. 1940. Field techniques in collecting for a research museum. Museum News, 17(17):6-8.**

Suggests a plan to improve collections by concentration on solving specific problems in the field and by a very improved data collection system. Good examples are given on types of information gathered and interpretation of peculiarities observed.

026 **Miller, E. H. (ed.) 1985. Museums collections: their roles and future in biological research. British Columbia Provincial Museum Occasional Paper no. 25. 222 pp.**

A compendium of excellent papers addressing the use of museum collections for study of biological systems. Some relevant works include G. A. Allen and R. A. Cannings, Museum collections and life-history studies; A. J. Baker, Museum collections and the study of geographic variation; G. F. Barrowclough, Museum collections and molecular systematics. Partially reviewed in Collection Forum, 3:35-39. See also Raikow, 1985 (No. 035).

027 **Northern, J. R. 1976. A view into a museum's bird collection. American Federation of Aviculture, 11:30-33.**

Not seen. Citation from Foster, 1982 (No. 013).

028 **Olson, S. L. 1981. The museum tradition in ornithology -- a response to Ricklefs. Auk, 98(1):193-195.**

A spirited retort to the paper by Ricklefs (1980, No. 037). Arguments are presented that there are insufficient recent specimens for many studies and unlimited areas for further research in systematics including use of the fossil record.

029 **Ouellet, H. 1983. On museum collecting. Toronto Field Naturalists Club Newsletter, no. 355:32-34.**

Basic statement about Ouellet's position on the collecting of specimens and the rare bird. Lists 13 papers on this general subject of which about half are covered in this bibliography.

030 **Parker, S. A. 1977*a*. Comments on the collecting of birds for taxonomic research. South Australian Ornithological Association Newsletter, September issue, pp. 8-11.**

Gives four basic reasons why specimens are necessary for taxonomic research and why other forms of data do not suffice. Also describes activities of the Bird Section of the South Australia Museum.

031 **Parker, S. A. 1977*b*. Further comments on collecting. South Australian Ornithological Association Newsletter, December issue, pp. 4-8.**

Convincingly dispels almost all the points made by Breed (1977, No. 005) in his argument against collecting.

032 **Parkes, K. C. 1963. The contribution of museum collections to knowledge of the living bird. The Living Bird, Second Annual of the Cornell Laboratory of Ornithology, pp. 121-130.**

Classic paper pointing out the immense amount of information that can be obtained from examination of study skins. Contains suggestions for improvement of labels and the data recorded on them.

033 **Phillips, A. R. 1974. The need for education and collecting. Bird Banding, 45(1):24-28.**

Well-written argument for collecting birds considered to be far outside of their normal range (prompted by a comment published in *Bird Banding* about collection of a Barn swallow 500 miles north of its breeding range).

034 **Porkert, J., and M. Grosseova. 1985. German.**

035 **Raikow, R. J. 1985. Museum collections, comparative anatomy and the study of phylogeny. Pp. 113-121, *in* Museum Collections: Their Roles and Future in Biological Research (E. H. Miller, ed.), British Columbia Provincial Museum Occasional Paper no. 25. 222 pp.**

Well thought out paper detailing how museum collections can prove invaluable for those systematists who work with anatomical material -- how to locate specimens, organize studies, publish results, and work with museum caretakers.

036 **Rea, A. 1986. So what good's a dead bird? Environment Southwest (San Diego Society of Natural History), 513:12-17.**

Good description in layman's terms of the value of bird skins in scientific collections, what goes into the making of these collections, and the types of information that can be retrieved from specimens.

037 **Ricklefs, R. E. 1980. Old specimens and new directions: the museum tradition in contemporary ornithology. Auk, 97(1):206-207.**

A somewhat convoluted paper in which the first paragraph states that museum science is dying and specimens have essentially served their purposes. The rest of the paper describes how valuable museums specimens can be.

038 **Ricklefs, R. E. 1981. Response: It's time for museums and biology departments to get back together. Auk, 98(1):196-198.**

Expounds upon what the author meant when he stated "the museum tradition in ornithology is dying" (Ricklefs, 1980, No. 037) -- that museum-based research has much less influence on the ornithological world than it did in the past, even the recent past.

039 **Snyder, L. L. 1958. Collecting birds and conservation. Ontario Field Biologist, 12:16-18.**

Snyder lists nine statements intended to reveal the purpose and effect of collecting birds and five statements explaining the value of collecting rare birds (in this case meaning a bird outside of its normal limits).

040 **Snyder, L. L. 1959. Collect the bird. Oriole, 24:21-25.**

Expanded version of Snyder, 1958, (No. 039) pointing out that a bird specimen is always more valuable than a sight record or photograph.

041 **Spencer, R., R. Hudson, and C. J. Mead. 1969. The collecting of rare birds. Ibis, 3:258.**

In response to an earlier published letter suggesting that a mist-netted bird which is liberated is no more than a sight record, the authors point out that current

ringers record large amounts of information (plumage characteristics, measurements, wing formula, ectoparasites, photographs) which can be as valuable as a cabinet skin.

042 **Storer, R. W. 1988. The need for more museum specimens of colonial waterbirds. Colonial Waterbirds, 11(1):123-124.**

Reiterated the statement made by Wood (1986, No. 046) that insufficient material exists in many groups to allow proper systematic work but suggests that collecting may be a better way than relying on salvage.

043 **Stuckenburg, B. 1986. The future of collecting and research in natural history museums. South African Museums Association Bulletin, 17(4):185-189.**

Discusses the current affairs of the museums of South Africa and prospects for the future. Cites a number of factors that make the worker of today more productive -- new equipment, computers, better transportation, etc.

044 **Tatem, J. B. 1974. On killing birds. Bird Banding, 45(4):315-319.**

A "pro-life" response to A. Phillips' paper of 1974 (No. 033).

045 **Vader, W. 1982. Norwegian.**

046 **Wood, D. S. 1986. The need for salvage of colonial waterbirds for museum specimens. Colonial Waterbirds, 9(1):124-125.**

Stresses that current museum collections are often inadequate for the study of colonial waterbirds and that these collections would benefit greatly by salvage of specimens.

047 **Zusi, R. L. 1969. The role of museum collections in ornithological research. Proceedings of the Biological Society of Washington, 82:651-661.**

Discusses the past and present roles of museums and collections and forecasts the increasing importance of specimens. Advocates that there be an inventory of ornithological specimens.

048 **Zusi, R. L., D. S. Wood, and M. A. Jenkinson. 1982. Remarks on a world-wide inventory of avian anatomical specimens. Auk, 99:740-757.**

Describes the history of this inventory published in two parts in 1982 (see Wood, Zusi, and Jenkinson, 1982*a* and *b* (Nos. 269 and 301). Tables are given to illustrate the relative sizes and diversity of collections as well as a summary of data for families or subfamilies of birds. Emphasizes that collecting should continue not only to supplement current material but especially to obtain species that do not yet have preserved anatomical material.

II. GENERAL PREPARATION - VERTEBRATES

This division includes those publications covering collection and preparation of more than one animal group. The publications by Anderson, 1965 (No. 052), Knudsen, 1966 (No. 073), and Wagstaffe and Fidler, 1968 (No. 094) are complete and well written. Of special mention are the works by Hangay and Dingley, 1985 (No. 067) and Piechocki, 1986 (No. 082), which are the most recent comprehensive texts in print, both containing extensive bibliographies.

049 Aiyappon, A., and S. T. Satymurti. 1960. Handbook of museum techniques. Government Printer, Madras. 228 pp.

Not seen. Citation from Inskeep, 1971 (No. 1217).

050 Allen, G. M. 1935. Instructions for collectors. Museum of Comparative Zoology at Harvard College. Pp. 304-335, *in* Harvard Travellers Club Handbook of Travel. Second edition. Cambridge, Massachusetts.

This section is titled "Natural History Collecting" and has short divisions on vertebrates, invertebrates, botany, and fossils. Basic information only.

051 Anderson, R. M. 1943. Instructions for preserving animal specimens for scientific purposes. National Museums of Canada Special Contributions, 43(2):1-34.

Basic manual describing in good detail the preparation of bird skins, mammals, reptiles, and amphibians. Illustrations are those used in later versions.

052 Anderson, R. M. 1965. Methods of collecting and preserving vertebrate animals. Fourth edition. National Museum of Canada Biological Series no. 18, Bulletin no. 69, 199 pp.

One of the most complete scientific preparation manuals in English. Initially written in 1932, it was revised in 1948, 1960, and 1965. Contains a reasonably complete bibliography but unfortunately it has not been thoroughly updated since the 1948 edition. Anderson included methods suggested by many contemporaries (whom he credits) in the 1930s and 1940s, and covers many of the unique methods used on various groups of birds. Includes good information on all vertebrate groups.

053 Areny, P., de. n.d. Spanish.

054 Bade, E. 1913. German.

055 Baer, H. W., and O. Grönke. 1975. German.

056 Biswas, B. 1968. A Handbook for Zoological Collectors. The Zoological Survey of India, India Press, Delhi. 152 pp.

General text edited by the Director of the Zoological Survey. The section on birds (pages 129-138) gives basic instructions with some unique methods such as hooking the tibias under the string wrapping the body.

057 Blanchon, H. L. A. 1910. French.

058 Bourlière, F. 1941. French.

059 **British Museum (Natural History). 1906. Handbook of instructions for collections. Third edition. Hazell, Watson & Viney, Ltd., London. v + 144 pp.**

This third edition is virtually identical to the first edition issued in 1902. Instructions are given for vertebrates, invertebrates, botany, fossils, and minerals. Pages 22-34 give basic instructions for birds. Reissued in 1921.

060 **Brucker, G., R. Flindt, and K. Kunsch. 1979. German.**

061 **Cerda C., J. 1977. Spanish.**

062 **Chani, J. M. 1980. Spanish.**

063 **Crabb, E. D. 1923. A handbook on preserving museum specimens in the field. Bulletin of the University of Oklahoma, 268:1-73.**

Basic information for preparation of game heads, mammals, birds, amphibians, reptiles, invertebrates, and fossils. Also has a section on tanning and formulas. The initial section which gives suggestions for camping is entertaining because of its datedness.

064 **Gentille, J. (ed.) 1977. Natural history specimens. Their collection and preservation. Western Australian Naturalists' Club Handbook No. 2 (5th edition). Western Australian Naturalists' Club, Perth, Australia. 71 pp.**

Despite the fascinating title, little space is given to vertebrates -- 4 pages to fish, 3 pages to amphibians and reptiles, and only 2 pages to birds and mammals. The majority of the text is devoted to botanical, fungal, and invertebrate specimens. A general section includes information on field recording and five pages discussing preservation with alcohol and formalin.

065 **Gestro, R., and D. Vinciguerra. 1926. Italian.**

066 **Hall, E. R. 1962. Collecting and preparing study specimens of vertebrates. University of Kansas Museum of Natural History Miscellaneous Publications no. 30. 46 pp.**

Classic preparation manual by this famous mammalogist. Good information on keeping a field notebook along with adequate material on preparation of mammals and birds. Some subjects, such as washing specimens, are not discussed. The amphibian and reptile section is by W. Duellman and the fish section is by F. B. Cross.

067 **Hangay, G., and M. Dingley. 1985. Biological museum methods. Volume I. Vertebrates. Academic Press, Sydney, Australia. xv + 379 pp.**

The most thorough overall museum techniques manual ever written. Each group in the animal world is covered in text with a generally large bibliography following each chapter. The greatest value of the book is in the taxidermy field where this book excels, collating methods used on four continents obtained in a world-wide tour. Unfortunately, all of the scientific disciplines are not treated completely, and in many cases it is clear that the authors did not fully comprehend a particular field. This is understandable, since this is the first book covering both scientific collecting and taxidermy, while also attempting to cover the world's literature.

068 **Harris, R. 1972. Natural history collecting. Grosset & Dunlap, New York. 158 pp.**

Despite its fascinating title, this book is essentially useless to the professional collector -- being written primarily for the strict amateur or school-age children.

Information is given for plants, all forms of invertebrates and vertebrates, and minerals.

069 **Horie, C. V., and R. G. Murphy (eds.) 1988. Conservation of natural history specimens - vertebrates. Proceedings of the short course at Manchester University. Manchester, England. 77 pp.**

Excellent collection of papers. Titles: Structure and properties of skin and bone; Preparation of bird study skins; Recent developments in taxidermy; Methods of bone preparation; Damage to skin and bone; Pests, pesticides and specimens; Treatment for deteriorated specimens; Cleaning fur; Display and curation of specimens; and Treatment of specimens for present and future use.

070 **Horvath, L. 1962. Hungarian.**

071 **Hvass, H. (ed.) 1942. Danish.**

072 **Jewett, S. G. 1914. Directions for preparing scientific specimens of large and small mammals, birds, birds' stomachs for economic investigations, birds' nests and eggs, fish and reptiles. Bulletin of the Oregon Fish and Game Commission, 1:1-19.**

The title is misleading since this volume gives directions on the preparation of bird skins, eggs, and stomach contents only. The information is accurate and concise with illustrations by the United States Biological Survey and O. J. Murie.

073 **Knudsen, J. W. 1966. Biological techniques: collecting, preserving and illustrating plants and animals. Harper and Row, New York. 535 pp.**

Good basic text on preparation of scientific study specimens. Pages 373-401 do a reasonable job on description of bird study skin preparation and related topics. The section on vertebrate skeletal techniques (pages 432-445) gives an adequate overview of clearing and staining, X ray technique, and preparation.

074 **Knudsen, J. W. 1972. Collecting and preserving plants and animals. Harper and Row, New York. viii + 320 pp.**

This edition is not as complete or thorough as the earlier work, cited above.

075 **Kung, K., R. Bahler, and W. Huber. 1970. Field work techniques in zoology. Pp. 155-171, *in* Field Manual for Museums. United Nations Educational, Scientific, and Cultural Organization. 171 pp.**

Part A deals with skinning and field measurements of large mammals primarily for taxidermy mounts. Part B deals with general preparation of birds with photos showing the steps involved, and Part C covers cold-blooded vertebrates.

076 **Larsen, H. 1948. French.**

077 **Löwegren, Y. 1939. Swedish.**

078 **Löwegren, Y. 1961. Swedish.**

079 **Mahoney, R. 1966. Laboratory techniques in zoology. Butterworths, Washington, DC. 404 pp.**

A unique manual much different from the others in this section. Topics such as histology and embryology are combined with chapters on museum technique and preparation of skeletons. The section on museum techniques includes display of fluid mounts in Perspex jars, cell mounts, embedding in blocks of plastic, impregnating in paraffin, making study skins, etc. The skeleton chapter discusses skeletons of the various groups (with illustrations) and preparation and mounting techniques.

080 **Museo Ecuatoriano de Ciencias Naturales. 1983. Spanish.**

081 **Nes, J. G. Th. van. 1952. Dutch.**

082 **Piechocki, R. 1986. German.**

083 **Post, G. 1967. Method of sampling and preserving field specimens for laboratory examination or laboratory analysis. Pruett Press, Inc., Boulder, Colorado. 73 pp.**

A well-written small format book consisting of concise directions on how to collect field samples so that they may be preserved properly until analysis in the laboratory. Written primarily for the field wildlife manager so that he may collect and preserve a wide array of specimens. Instructions include collecting tissues from specimens; parasites; bacteria; blood; stomach samples; soil, plant, and plankton samples; water, etc. Also contains directions for preparation of various fluid specimens. Contains numerous formulas.

084 **Poulsen, C. M. 1963. Danish.**

085 **Roquette-Pinto, P. 1938. Portuguese.**

086 **Satyamurti, S. T. 1965. The preservation of biological specimens. Department of Museology, Maharaja Sayajirao University Baroda, Baroda, India. iv + 120 pp.**

Not seen. Citation from Williams and Hawks, 1987 (No. 1115).

087 **Schlater, R. P. 1973. Spanish.**

088 **Selmons, M. 1911. German.**

089 **Seton, E. T. 1912. The book of woodcraft. Garden City Publishing Co., Garden City, New York.**

Pages 269-280 contain information on making bird skins and mounts, and pages 281-284 on measurement and preparation of skins of mammals was contributed by C. Hart Merriam. The text is designed primarily for amateurs.

090 **Simpkins, J. 1974. Techniques of biological preparation. Blackie & Son, Glasgow and London. 100 pp.**

General text written for biology teachers. Includes chapters on taxidermy and skeletal preparation which are of little value to the professional.

091 **Smithsonian Institution. 1944. A field collector's manual in natural history. Smithsonian Institution Publication no. 3766. iv + 118 pp.**

Small format handbook for inclusion in a collector's kit. The section on birds gives a fair description of preparation of study skins.

092 **Steenberg, C. M. 1932. Danish.**

093 **Vanzolini, P. E., and N. Papavero (coordense dores). 1967. Portuguese.**

094 **Wagstaffe, R., and J. H. Fidler. 1968. The preservation of natural history specimens. Philosophical Library of London. Volume II, Part 2. Zoology - Vertebrates. H. F. and G. Whitherby Ltd. xv + 404 pp.**

One of the most complete recent scientific preparation manuals in English. Forty-five pages are devoted to bird study skins, eggs, and nests, with an amazing amount of good information. Covers the basics as well as specific details about unique

preparations. Contains very useful appendices on 1) instruments, apparatus, and miscellaneous materials; 2) preservatives; and 3) labels and labeling.

095 **Wells, M. M. 1932. The collection and preservation of animal forms. General Biological Supply House, Chicago, Illinois. 72 pp.**

Small book covering the entire animal world, designed primarily for biology teachers. Only two pages are devoted to birds and about one page to skeleton preparation.

096 **Wobeser, G. A., T. R. Spraker, and V. L. Harms. 1980. Collection and field preservation of biological materials. Pp. 537-551, *in* Wildlife Management Techniques Manual. Fourth edition (S. D. Schemnitz, ed.), The Wildlife Society, Washington, DC. 686 pp.**

This chapter gives an excellent overview of the variety of methods used to preserve life forms. It contains a table summarizing methods while referring the reader to more complete works. Precautions and recommendations are given for preservation of specimens at necropsy (histopathology, microbiology, parasitology, toxicology). A short section describing study skin preparation from Anthony, 1950 (No. 1124), on mammals and Chapin, 1946 (No. 106), on birds.

097 **Zangheri, P. 1981. Italian.**

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098 **Grinnell, J. 1929. Suggestions as to collecting. Typewritten instructions. 8 pp. (Copy at Carnegie Museum of Natural History.)**

Field notebook insert with numerous miscellaneous tips on collecting, handling, and shipping specimens, and suggestions for keeping life history notes.

099 **Hall, E. R. 1946. Suggestions for collecting. 16 pp. (Copy at Carnegie Museum of Natural History.)**

Typewritten college handout to accompany data recording in a field notebook. Information on labeling specimens, field preparation of vertebrates, etc.

100 **Wood, C., *et al.* n.d. Museum preparator procedures -- bird and mammal collections. University of Oklahoma. 68 pp.**

Typewritten booklet prepared for in-house use at the University of Oklahoma. Contains information on specifications for loading shotshells, use of the computer, preparation of bird and mammal study skins, initial preparation of skeletons by dermestids and maceration, final cleaning and boxing of skeletons, bird range policy, mailing specimens and fumigation. Includes paper by Luchanski, 1981 (No. 447).

III. BIRD PREPARATION - GENERAL AND STUDY SKIN PREPARATION

Publications in this division include those dealing with study skin preparation and all other bird papers not specifically covered in other divisions. There are a number of well written papers on the subject of bird study skin preparation. Many are older works, and the materials used are no longer recommended (arsenic, alum, etc.) but the techniques described are very good. Of particular interest are papers by Blake, 1949 (No. 105), Chapin, 1940 (No. 106), Coues, 1874 (No. 109), and Ridgway, 1891 (No. 132), all outstanding ornithologists for their time period. The most recent complete publication has come out in manuscript form only but is quite good (Schmidt, 1982, No. 154).

101 Anicete, B. 1966. Collection and preservation of bird specimens and a comparative study of their sclerotic ring in relation to their habits and habitat. University of Philippines Research Digest, 5:20-22.

Short paper suggesting that researchers save more of a bird than just the study skin. The majority of the paper is devoted to speculation on differences in the sclerotic ring among birds.

102 Anonymous. 1954. Birds and their eggs. Instructions for collectors. Ninth edition. British Museum (Natural History), London. 36 pp.

Reasonably complete booklet on preparation of birds, primarily for field use. Improved considerably from the earlier handbooks of instructions (see British Museum [Natural History], 1906, No. 059) but still sharing some of the same illustrations.

103 Anonymous. 1957. How to make a bird skin for scientific study collections. North Carolina State Museum, Information Circular, 57-7. 11 pp.

Small pamphlet for the layman on bird study skin preparation.

104 Anonymous. 1957. Suggestions for collecting and preserving specimens of birds and their eggs. Smithsonian Information Leaflet no. 123. 11 pp.

Small pamphlet describing preparation of study skins, eggs, and initial preparation of skeletons.

105 Blake, E. R. 1949. Preserving birds for study. Fieldiana: Technique no. 7. 38 pp.

One of the best American publications on the preparation of bird study skins, with very good detail and illustrations. Very similar to that of Chapin (1940, No. 106) and even utilizes some of the abbreviated notations found there to promote conformity. Contains little information on skeletons or fluid specimens.

106 Chapin, J. P. 1940. The preparation of birds for study. Instructions for the proper preparation of bird skins and skeletons for study and future mounting. American Museum of Natural History Guide Leaflet, 58:1-48.

One of the best American preparation manuals on bird skinning to date. Great details on skin preparation but insufficient information on fluid preparation and only adequate information on preparation of rough skeletons. Many chemicals recommended are out of date. Also published in 1923 and 1946. Essentially translated to French (Schouteden, 1953, No. 136) and literally translated to Spanish (Chapin, 1965, No. 107).

107 Chapin, J. P. 1965. Spanish.

108 **Chapman, F. M. 1932. Handbook of birds of eastern North America. D. Appleton and Co., New York. 581 pp.**

Pages 16-23 entitled "Collecting birds, their nests and eggs" is a concise chapter on collecting and preserving of bird skins.

109 **Coues, E. 1874. Field ornithology comprising a manual of instruction for procuring, preparing, and preserving birds and a check list of North American birds. Salem: Naturalists Agency. Boston: Ester & Lauriat. New York: Dodd and Mead. Bound together - iv + 116 pp (field manual); 117-137 pp (checklist).**

Pages 52-82 contain the first thorough description written in America of preparation of birds for scientific study. The procedures for making a bird skin could be used today with only minor changes. Information on taxidermy is also provided though this section is now completely outdated.

110 **Coues, E. 1903. Key to North American birds. Volume 1. The Page Co., Boston. xli + 535 + 46 (index) + 8 (appendix).**

This text reprints (almost identically) the information on preparation contained in the 1874 volume (No. 109).

111 **Cowan, I. McT. 1938. Mounting bird skins, nests and eggs for circulation. Museums Journal, 38:269.**

Minor note describing an innovation in preparing high school loan study skins in glass tubes with a wire extending lengthwise through the bird and fixed in the cork ends. The suggestion on filling eggs with paraffin proved later to be undesirable as the shells cracked.

112 **Delacour, J. 1932. French.**

113 **Dill, H. R. 1957*a*. Skinning a bird for taxidermy. Museum Graphic, 9(1):18-20.**

Basic description of skinning for preparation as a study skin or taxidermy mount with photo illustrations using a pigeon.

114 **Dill, H. R. 1957*b*. Making a scientific bird skin. Museum Graphic, 9(2):31-33.**

Unique description of a study skin made by filling the head and neck of a skinned bird with balsa wood sawdust then wrapping the body with cotton wound on a stick which is not anchored in the head section.

115 **Dupond, C. 1949. Bird skins. Two taxidermic suggestions for bird collections. Taxidermist News, 11:4-5.**

The first recommendation is that one example of a male and female of each species be prepared with one wing half open and the tail slightly spread to facilitate study. The second is a suggestion to tie the labels not to the crossed legs but to a wire which goes lengthwise through the bird and is anchored in the head.

116 **Eck, S. 1978. German.**

117 **Fitch, J. H. 1967. Collecting and preparing scientific specimens. Pacific Bird Observer, 7:1-5.**

Basic description on preparation of a larger bird skin using photographic illustrations of a sea bird.

118 **Gast, R. 1935. German.**

119 Green, H. O. 1918. Making skins of owls and herons. Oologist, 35(2):19-23.

Suggests that plaster of Paris never be used for owls as it leaves more of a residue, and that sawdust would be better. Also suggests that the heavy wings can be supported by stitches through both wings and body. Outlines a unique method of filling heron skins with a paper cone which extends from the skull to abdomen and is partially filled with cotton.

120 Grinnell, J. 1924a. Review of Chapin's guide to "The Preparation of Birds for Study". Condor, 26:82-83.

Generally praises Chapin's work and points out four areas that Grinnell wholeheartedly agrees with. However, he emphasizes that a permanent label be made out at the time of preparation, thus criticizing Chapin's temporary "collector's label".

121 Grinnell, J. 1924*b*. An improved bird-skin for class use. Condor, 26:107-108.

Suggests that when bird skins are prepared for class use they have a stick anchored in the head extending well beyond the tail to facilitate handling and prevent excessive damage.

122 Halford, S. A. 1987. "Cased" bird skins -- an alternate opening incision. Collection Forum, 3(1 & 2):13.

The author reinvents this method of the initial cut for skinning birds. This method was mentioned by Coues in 1874 (No. 109).

123 Harrison, C. J. O., and G. S. Cowles. 1970. Instructions for collectors. 2A. Birds. Trustees of the British Museum, London. 48 pp.

Reasonably good field preparation manual for study skins of birds; initial preparation of skeletons; and collection of eggs, nests, parasites, stomachs, etc. Though essentially complete, there is surprisingly absolutely no mention of washing or even blood removal from the plumage. Appendix I has a useful chemical and material section.

124 Lucas, F. A. 1881. Hints about making bird skins. Ward's Natural Science Bulletin, Volume 1, Number 1. Rochester, New York.

Page 12 gives some suggestions for making bird skins which would make the bird easier to mount at a later time. Reprinted in 1882 in Volume 1, Number 2.

125 Mendez, J. L., and S. F. Martin. 1949. Spanish.

126 Morden, J. A. 1892. Pointers on making bird skins. Oologist, 9(4):104-106.

Short article describing some of the methods used by the author to make study skins. The quote that no "man...can safely claim to have such a perfect knowledge of practical bird skin collecting and taxidermy [preparation], that improvement in some detail is not possible" still rings true today.

127 Murphy, R. C. 1936. Oceanic birds of South America. Volume 1. The American Museum of Natural History, New York. 640 pp.

Page seven gives a short description of the methods employed by Rollo Beck, one of the best scientific bird skin preparators in history.

128 Paris, C. B. 1950. Plastic cases for bird skins. Museum News, 28(4):7-8.

Describes the creation of plastic cases to hold bird skins on loan to educational institutions for the purpose of teaching bird identification in elementary and

secondary schools. The cases are made individually to fit each bird and consist of a flat piece of plastic with a semicircular cover that acts as a canopy over the bird which is pinned to the base.

129 **Peabody, P. B. 1908. Preparation of bird skins. Oologist, 25(5):71, 73-74.**

Offers a number of pointers on his method of preparation of bird skins, e.g., the mandibles are pinned shut, a wire support is used for the neck. He also offers tips for getting good form to the skin. Suggests that labels be made of thin linen and well marked with good ink to prevent fading.

130 **Pettingill, O. S., Jr. 1985. Ornithology in laboratory and field. Fifth edition. Academic Press, Inc., Orlando, Florida. xi + 403 pp.**

Excellent general ornithology text. Earlier editions in 1939, 1946, 1956, and 1970.

131 **Pinto, O. M. O. 1938. Portuguese.**

132 **Ridgway, R. 1891. Directions for collecting birds. United States National Museum Bulletin no. 39, 27 pp.**

A general text covering all aspects of collecting and preparing study skins of birds. Includes illustrations of tools commonly found in a preparator's kit at that time, as well as a list of water color paints so that the colors may be reproduced exactly. An adequate description of skinning technique is given with many miscellaneous field tips. No mention of skeletons or pickles.

133 **Rockwell, R. H. 1917. Mounting the sportsman's trophies. Success in preserving intact the delicate color patterns of bird skins is a matter of patience, perseverance, and practice. Forest and Stream, (volume unknown):536-537.**

Basic instructions for skinning and preparation of a study skin using a Bobwhite Quail as an example.

134 **Rogers, S. P. 1986. The museum study skin. Breakthrough, 13:68-69, 71, 73.**

Concise paper describing the preparation of study skins. Written primarily in response to an earlier paper describing skinning birds which purportedly was the principal method used for making study skins (see Williamson, 1986, No. 827).

135 **Schorger, A. W. 1945. Absorbant for use in the preparation of scientific skins. Wilson Bulletin, 57:261.**

Minor note suggesting that finely ground cellulose "flock" produced from wood pulp or cotton works as an excellent absorbent.

136 **Schouteden, H. 1953. French.**

137 **Serié, P. 1918. Spanish.**

138 **Shipues, K. n.d. Norwegian.**

139 **Snyder, L. L. 1935. Some equipment and appliances developed at the Royal Ontario Museum of Zoology. Museum News, 13(10):6-7.**

The section entitled "Form for Bird Skins" describes the making and use of a cardboard form in which freshly-made study skins are held in shape until drying.

140 **Stanford, J. S. 1937. Boxes for study skins. Science, 85:460.**

Short article suggesting use of two products, Plastocele and Pyralin, which can be used to make transparent boxes for protection of bird and mammal study skins.

141 **Van Tyne, J., and A. J. Berger. 1976. Fundamentals of ornithology. Second edition. John Wiley & Sons, New York. xv + 808 pp.**

General ornithology text. First edition published in 1959.

142 **Wallace, G. J., and H. D. Mahan. 1975. An introduction to ornithology. Third edition. MacMillan Publishing Co., Inc., New York. xiv + 1-546 pp.**

General ornithology text. First edition published in 1955; second edition in 1963.

143 **Watson, G. E. 1962. A bird skin drying form for field use. Bird Banding, 33:95-96.**

Suggests two improvements for drying forms. The first is to place a small amount of PDB on the back of the skin in a solid aluminum form and the second is to use hardware cloth or screening instead of the solid aluminum.

144 **Wood, A. A. 1942. Cold storage as an aid to the busy ornithologist. Canadian Field Naturalist, 56:137-138.**

Innovative paper (for that time) detailing actual experiments on placing birds in meat locker freezers and then removing and skinning them. Makes you appreciate the plastic bag and refrigerator freezer. An earlier paper by E. A. Stoner appearing in 1938 (Oologist, 55(12):136), noted that the ordinary electric refrigerator can be of great service to the taxidermist.

145 **Wood, M. 1957. An improved drying form for bird study skins. Bird Banding, 28:156-157.**

Details a drying form made from aluminum or stainless steel which is curved and nailed to a wooden board. Gives dimensions for eight standard sizes.

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146 **Anonymous. n.d. Directions for preparing museum study skins. Los Angeles County Museum of Natural History. 3 pp.**

Simple step-by-step procedure for making a study skin.

147 **Anonymous. circa 1954. Suggestions for collectors. 14 pp. (Copy at Carnegie Museum of Natural History.)**

Good paper most valuable because of the seven pages devoted to label information. Also includes tips on field care of skins, initial preparation of skeletons, fluid preparation, parasites, etc.

148 **Davis, C. V. n.d. How to salvage dead birds -- method for making study skins. Zoology Department handout, Montana State University, Bozeman, Montana. 2 pp.**

Small student handout giving instructions for preparation of study skins.

149 **Harris, S. W. n.d. Bird skinning: check list; bird stuffing: check lists. Humboldt State University, Arcata, California. 3 pp.**

Better-than-average handout for students enrolled in a beginning museum technique course. Details 40 points to remind the novice of important steps.

150 **Huels, T. R. n.d. Instructions for preparation of a study skin of a bird. Department of Ecology and Evolutionary Biology, University of Arizona, Tucson. 3 pp.**

College handout describing bird skin preparation.

151 **Kennedy, R. S. n.d. Instructions on how to skin a bird. Cincinnati Museum of Natural History, Cincinnati, Ohio. 3 pp.**

Step-by-step description of making a study skin by using a ventral cut but placing it between the keel and the furcula and skinning the wings first and the tail last.

152 **Murphy, G. B. 1980. Ornithological laboratory procedures. Royal Ontario Museum departmental manual, Toronto. iii + 56 pp.**

Very good in-house manual of the procedures used at the Royal Ontario Museum. Gives adequate information on preparation of a study skin, pneumatization, sexing, bursae, and original information on the preparation of the ROM skin (skin without the skull and one set of leg and wing appendages which are skeletonized). Also describes fluid preparation, eggs, skeleton cleaning, body measurements, cataloguing, and label information.

153 **Parkes, K. C. n.d. Some tips on preparation of study skins for the Section of Birds. The Carnegie Museum of Natural History in-house manual, Pittsburgh, Pennsylvania. 3 pp.**

Details five areas that can vastly improve the quality of a study skin and six types of information which should be found on the label.

154 **Schmidt, R. H. 1982. Preserving bird skins for study. Unpublished manuscript, Second edition, Richard H. Schmidt, Newton, Kansas. 60 pp.**

One of the most recent scientific bird preparation manuals in English. Schmidt was able to work with many of this century's best American bird skinners and, as a result, the text is not only complete but has much information not found elsewhere.

155 **Schnell, G. D. 1976. Bird skinning techniques. Department of Biology, University of Oklahoma, Norman, Oklahoma. 2 pp.**

Details the preparation of study skins in 60 steps.

156 **Snyder, D. B. 1988. Ornithology 542. Directions for preparing bird skins. Pymatuning Laboratory of Ecology class handout, Summer, 1988, Edinboro University, Edinboro, Pennsylvania. 2 pp.**

Contains basic information on preparation of a bird skin but with little detail.

157 **Wood, D. S. 1978. Procedure for making a study skin of a bird. University of Oklahoma, Norman, Oklahoma. 8 pp.**

Expanded version of Schnell, 1976 (No. 155), giving 68 detailed steps for preparation of a study skin.

IV. SKELETON PREPARATION

Included in this section are all papers describing methods of preparing skeletal material by chemical (bases, acids, enzymes) and biological (bacterial, crustaceans, amphipods, dermestids, etc.) means. Publications on articulation of skeletons are also included. No major work has been written summarizing all the types of preparation and articulation of vertebrate skeletons. Complete understanding of skeletal preparation can only be obtained by consulting the primary literature listed below.

158 **Adams, J. M. 1980. Osteological preparation techniques II. Guild of Taxidermists no. 5.**

Not seen. Citation from Adams, 1986 (No. 159).

159 **Adams, J. M. 1986. Articulating a badger skeleton. Guild of Taxidermists no. 15:12-23.**

One of the most recent papers on this subject. Bones were prepared by simmering and hot water maceration, degreased in acetone, bleached in hydrogen peroxide, and articulated using wire and Superglue. Cartilage was replaced with plastic-coated wire.

160 **Allen, E. R., and W. T. Neill. 1950. Cleaning mammal skeletons with meal worms. Journal of Mammalogy, 31:464.**

Short note suggesting that meal worms are a possible alternative to dermestids for cleaning mammal skeletal material.

161 **Anonymous. 1931. How to make skeletons. Turtox Service Leaflet no. 9. 2 pp.**

Preparation using the ligamentary method. Details room temperature maceration followed by washing in sodium hydroxide and degreasing in carbon tetrachloride and ammonia. No information is given on mounting. Reissued in 1958.

162 **Anonymous. 1962. A method for skeleton preparation. Carolina Biological Supply Co., Burlington, North Carolina. 19 pp.**

Describes chemical maceration by sodium hypochlorite, degreasing with carbon tetrachloride or ammonium hydroxide, and bleaching in hydrogen peroxide. Some information on mounting.

163 **Anonymous. 1983. The preparation of osteological specimens. Guild of Taxidermists no. 11.**

Not seen. Citation from Adams, 1986 (No. 159).

164 **Applegarth, J. S. 1977. How to prepare an articulated snake skeleton. Colorado Herpetologist, 3(1):6-10.**

Not seen. Citation from Simmons, 1987 (No. 1182).

165 **Banta, B. H. 1961. The use of clothes moth larvae (Lepidoptera: Tineidae) to prepare osteological specimens, with an annotated bibliography on the use of other arthropods for vertebrate skeletal preparation. Wasmann Journal of Biology (London), 19:265-268.**

Not seen. Citation from Williams *et al.*, 1977 (No. 1158).

166 **Barlett, L. M. 1961. Dermestids killed when feeding on skeletons of birds killed by organic insecticides. Wilson Bulletin, 73(2):207.**

Reports on an attempt to use dermestid beetles to clean bird carcasses which had died of toxicity of certain organic insecticides. The poisons remaining in the meat were enough to kill the dermestids feeding on it.

167 **Berger, A. J. 1955. Suggestions regarding alcoholic specimens and skeletons of birds. Auk, 72:300-303.**

Recommends that extreme care be used in preserving fluid specimens and that adequate data are a necessity. Suggests that there is a need for more specimens and that research should be conducted on other fluid preservatives. Useful recommendations on the preparation of skeletons. The author prefers "rough" rather than shiny-white bleached skeletons.

168 **Bolin, R. L. 1935. A method of preparing skeletons of small vertebrates. Science, 82(2132):446.**

Describes a method of cleaning skeletons with marine isopods. Most work was done on fish.

169 **Bond, R. M. 1939. The care of skulls and skeletons of small mammals. Science, 89:324.**

Short note describing the drying of skeletal material in the field by suspending it under the hood of an automobile in use.

170 **Borrell, A. E. 1938. Cleaning small collections of skulls and skeletons with dermestid beetles. Journal of Mammalogy, 19:102-103.**

Step-by-step description of cleaning mammal skulls including blowing brains, soaking in water, submitting to a dermestid colony and cleaning with ammonia. Introduces the operation of force-feeding of material.

171 **Brown, J. C., and G. I. Twigg. 1967. The rapid cleaning of bones in quantity. Journal of Zoology, London, 153:566-567.**

In order to process a constant flow of mammals for skeletonization, the authors resorted to pressure cooking the carcasses in an autoclave at 10 lb/in^2 for 30 minutes for small mammals, and 40 minutes at 15 lb/in^2 for medium-sized mammals. Upon removal, the bones were picked and then soaked in water for a few days. Also suggests sodium hypochlorite may be of use for cleaning preserved material.

172 **Brunstetter, R. T. 1988. Removing rust stains from bones. Curator, 31(2):106-107.**

Used hydrofluoric acid to clean the surface of manatee bones which had rust stains from earlier maceration in metal drums.

173 **Case, L. D. 1959. Preparing mummified specimens for cleaning by dermestid beetles. Journal of Mammalogy, 40:620.**

Outlines presoaking of unpalatable skeletons in ammonia prior to cleaning them with dermestids.

174 **Chapman, D. I., and N. Chapman. 1969. The use of sodium perborate tetrahydrate ($NaBO_3 \cdot 4\ H_2O$) in the preparation of mammalian skeletons. Journal of Zoology, 159:522-523.**

Describes the use of sodium perborate to clean mammal skeletons. A 2.5% (by weight) solution is prepared by adding the chemical to boiling water containing the partially cleaned skeleton, which is left in the solution for several hours and cleaned by washing in hot water containing a small amount of detergent.

175 **Coleman, E. J., and J. R. Zbijewska. 1968. Defleshing of skulls by beetles. Turtox News, 46(7):204-205.**

Description of the set up of a beetle colony using a container with a base of topsoil with specimens presented in wire cages surrounded by a moat of weak formalin. Unique in that no lid is used and heads are not skinned. Uses funnel with spotlight to separate beetles from specimens. Stores back-up food in a freezer.

176 **Coy, J. 1980. Osteological preparation techniques I. Guild of Taxidermists no. 5.**

Not seen. Citation from Adams, 1986 (No. 159).

177 **Crosbie, J. 1959. Preparation for the mounting of the skeleton of a small mammal. Journal of Science and Technology, 5(1):pages unknown.**

178 **Cumbaa, S. L. 1983. Osteological preparation techniques used by the zooarchaeological identification center. Pp. 29-35, in Proceedings of 1981 Workshop on Care and Maintenance of Natural History Collections (D. J. Faber, ed.), Syllogeus no. 44, National Museums of Canada, Ottawa. 196 pp.**

Describes use of dermestids, maceration, and boiling. Suggests use of cheesecloth to cover specimens in colony and to slow drying of large bones to prevent cracking, freezing skeletons to kill larvae, and warns against sensitization to bug dust. Glosses over enzyme maceration methods and does not identify the chemical used.

179 **Curtis, E. L., and R. C. Miller. 1938. The sclerotic ring in North American birds. Auk, 55:225-243.**

Classic work on this subject outlining value of the sclerotic ring in the completed skeleton and stressing preservation of this element.

180 **de Klerk, W. A., L. Abrams, and L. S. Pretorius. 1964. Assembling avian and small animal skeletons by using a chemical aid. Journal of South African Veterinary Medicine Association, 35:89-91.**

181 **de la Torre, L. 1951. A method for cleaning skulls of specimens preserved in alcohol. Journal of Mammalogy, 32:231-232.**

Skulls are kept in running water for two days, dried for about an hour, brushed with liquid grease made of warmed bacon and beef fat, and force-fed to dermestids in jars or aquaria.

182 **Egerton, C. P. 1968. Method for the preparation and preservation of articulated skeletons. Turtox News, 46(5):156-157.**

Skeletons are roughed out, presoaked in 7% ammonium hydroxide for 20 days, then chemically macerated in pancreatin and sodium hydroxide for 45 minutes to three hours. They are next bleached in hydrogen peroxide, and degreased in carbon tetrachloride after drying.

183 **Eyton, T. C. 1859. On the different methods of preparing natural skeletons of birds. Ibis, 1:55-57.**

Early paper describing ligamentary method of articulating skeletons using maceration in common alum and salt or, in the case of dried skeletons, in potassium carbonate or potassium hydroxide.

184 **Feduccia, J. A. 1971. A rapid method for the preparation of avian skeletal material. Texas Journal of Science, 23(1):147-148.**

Outlines a step-by-step procedure which relies on the use of two short boilings in weak Calgon separated by water maceration for four to seven days.

185 **Finlayson, H. H. 1932. A simple apparatus for degreasing bones for museum purposes. Transactions of the Royal Society of South Australia, 56:172-174.**

One of the first articles describing thoroughly the use of what has now come to be called a vapor degreaser. A solvent is boiled in a closed system with a condenser on top and the bone material suspended on a false bottom. Vapor and clean solvent then continuously bathes the material until it is thoroughly degreased.

186 **Fisher, C., and G. McInnes. 1980. Preparing bones the Scouse way. Association of Environmental Archaeologists Newsletter, 5:5-6.**

An innovative method using an old aquarium stainless steel filtration unit with a heating and stirring system maintained at 37°C and containing pancreatin. Specimens are initially boiled and then suspended in mesh bags or nylon stockings in the enzyme bath for five to ten days, whereupon they are boiled briefly in detergent and sodium perborate.

187 **Fisher, C., and G. McInnes. 1981. An enzyme technique for the rapid preparation of osteological specimens. Biology Curator's Group Newsletter, 2(9):408-410.**

More detailed description of method in earlier paper (No. 186) with an illustration of the set up.

188 **Flower, W. H. 1877. On the preparation of skeletons for museum purposes. Zoologist (3rd series), 1:465-468.**

Possibly the first paper describing pure water maceration (without chemicals) and non-use of boiling to clean skeletons.

189 **Friedman, E. 1973. Preparation of faunal specimens. American Antiquity, 38:113-114.**

Very short paper describing the preparation of skeletons by placing the carcasses in mesh bags submerged in the ocean below the low tide line. Various sorts of invertebrates combined with bacterial action clean the skeletal material.

190 **Gantert, R. L. 1967. The preparation of skeletal mounts. American Biology Teacher, 29(7):531-534.**

Describes the trials and tribulations of a high school biology class dealing with articulation of skeletons. Some chemicals tested are trisodium phosphate and calcium hydroxide. Formalin-stained bones were covered with "antique ivory" paint.

191 **Gennaro, A. L., and T. J. Salb. 1972. An outdoor enclosure for dermestid defleshing operations. Southwestern Naturalist, 17:95-96.**

Describes and illustrates modification of an inoperative chest freezer to house a dermestid colony.

192 **Gilbert, B. M., L. D. Martin, and H. G. Savage. 1981. Avian osteology. Published by author, Laramie, Wyoming.**

This book was designed primarily for identification of faunal specimens from archaeological digs. Keys and illustrations are given for all the major bird bones likely to be encountered in North America. Only larger birds are covered, i.e., no Passeriformes or small woodpeckers, sandpipers, etc. Illustrations are not uniform, sometimes over 60 species elements are covered and at other times just a diagrammatic one is presented. Contains some keys to elements and tables with size ranges. Invaluable for those without access to a skeleton collection.

193 **Green, H. L. H. H. 1934. A rapid method of preparing clean bone specimens from fresh or fixed material. Anatomical Record, 61:1-3.**

Describes the use of antiformin (composed of sodium carbonate, bleaching powder [sodium hypochlorite?], sodium hydroxide, and water). The author suggests caution to prevent damage to material, but insists that if carefully monitored, even small birds can be prepared perfectly.

194 **Gross, J. E., and B. L. Gross. 1960. Jackrabbit humeri cleaned with Clorox. Journal of Wildlife Management, 30:212.**

Bones were cleaned in full strength Clorox to demonstrate epiphysal cartilage. Noted damage to some bones.

195 **Hall, E. R., and W. C. Russell. 1933. Dermestid beetles as an aid in cleaning bones. Journal of Mammalogy, 14:372-374.**

Pioneering paper on establishing a dermestid colony for use in cleaning bone material of small and medium-sized vertebrates. Ammonia was used for final cleaning. Simmering was advocated for cleaning large skeletons.

196 **Hamon, J. H. 1964. The technique of preparing bird skeletons for study by maceration. American Biology Teacher, 26:428-431.**

Describes and illustrates maceration of bird skeletons in tap water, which the author considers superior to other methods of bone preparation.

197 **Hardy, R. 1945. Dermestid beetles for cleaning skulls and skeletons in small quantities. Turtox News, 23(4):69-70.**

Describes maintaining many small colonies in gallon jars instead of using a large bugroom. Also suggests drying carcasses in erect positions and monitoring the cleaning carefully to produce completely articulated skeletons of small mammals.

198 **Harris, R. H. 1951. The use of enzymes in the osteological preparation of the emperor penguin. Museums Journal, 51:97.**

Article describes the cleaning of some extremely difficult carcasses by simmering in pancreatin followed by warm water maceration in papain.

199 **Harris, R. H. 1959. Small vertebrate skeletons. Museums Journal, 58:223-224.**

Describes in detail the preparation of skeletal material by use of the enzymes pancreatin and papain and the macerator antiformin -- pancreatin for articulated skeletons, papain for complete disarticulation, and antiformin for material stored in alcohol or formaldehyde for a long time.

200 **Haynes, R. C., F. E. Purrington, and R. A. Coler. 1967. Articulating a yak skeleton. Carolina Tips, 30:26-27.**

Not seen. Citation from Jakway, Raskin, and Tytle, 1970 (No. 215).

201 **Hildebrand, M. 1968. Anatomical preparations. University of California Press, Berkeley, California. viii + 100 pp.**

A truly valuable work which reviews preparation of anatomical material primarily for teaching use. Pages 16-34 contain concise information on boiling, maceration (water and chemical), dermestid beetles, digestion, bleaching, degreasing, washing, and articulation.

202 **Hill, F. C. 1975. Techniques for skeletonizing vertebrates. American Antiquity, 40(2):215-219.**

Outlines a method for cleaning material using warm (45°C) water maceration for fish, amphibians and reptiles, and other small vertebrates. Most mammals and birds required papain treatment. In some cases, final cleaning is by immersion in hot 15% potassium hydroxide or sodium hydroxide for up to a minute.

203 **Hiller, A. 1969. An alternative method of bone preparation. Kalori, Journal of the Museums Association of Australia, 36:35.**

Describes the use of sodium perborate. The carcass is first defleshed and soaked in cold water for 24 hours to remove blood which may stain the bones. The specimen is then dropped in boiling water simultaneously with sodium perborate (60-70 g/L for small specimens, 70-100 g/L for large) and allowed to cool. Three to four days later the specimen is removed and cleaned. If desired, hydrogen peroxide may be used for bleaching and ammonia for greasy bones.

204 **Hoffman, A. C. 1939. A new method of mounting skeletons. South African Museums Association Bulletin, 2(1):9-12.**

Minor paper describing the preparation of articulated skeletons for display. Skeletons were cleaned by short boilings followed by maceration and bleaching in the sun. They were then articulated in a lifelike attitude with individual bone support using copper wires or a glue called Metallic X.

205 **Hoffmeister, D. F., and M. R. Lee. 1963. Cleaning mammalian skulls with ammonium hydroxide. Journal of Mammalogy, 44(2):283-284.**

Suggests an alternative to cleaning with dermestid beetles by soaking and then boiling in concentrated ammonium hydroxide. It works well even on very old and dried skeletons uncleanable with bugs. It may cause damage to skull so care is advised.

206 **Holden, F. H. 1914. A method of cleaning skulls and disarticulated skeletons. Condor, 16:239-241.**

Advocates simmering in a solution of phenol (carbolic acid) and ammonia until tender, followed by simmering in clear water, then hand cleaning and immersion in hydrogen peroxide.

207 **Holden, F. H. 1916. Cleaning skulls and skeletons: A supplementary note. Condor, 18:231.**

Recommends replacing phenol as suggested in the preceding paper with cresylic acid (cresol).

208 **Hooper, E. T. 1950. Use of dermestid beetles instead of cooking pots. Journal of Mammalogy, 31:100-102.**

Strongly stresses that mammalogists only use dermestids to clean skeletal material as it is much less damaging to the skull and probably more cost effective.

209 **Hooper, E. T. 1956. Selection of fats by dermestid beetles. Journal of Mammalogy, 37:125-126.**

Tested the selection by dermestid beetles of a number of substances (mostly fats) by coating pieces of dried meat which were then submitted to a colony. The most enticing substance was cod liver oil which was evaluated using a series of borax-coated dried ground squirrel skulls and found to be very effective.

210 **Howell, A. B. 1919. An easy method of cleaning skulls. Journal of Mammalogy, 1(1):40-41.**

Mammal skulls are cleaned by first removing large muscle masses, soaking in water followed by alcohol and sometimes naphtha, and again soaking in water. They are then simmered in an open pan containing hydrogen peroxide and finally hand cleaned.

211 **Howell, A. B. 1920. A supplementary note on cleaning skulls. Journal of Mammalogy, 1(3):145.**

Recommends abandonment of the second soaking in water (from the preceding paper), and the use of a double boiler instead of an open pan.

212 **Hubbel, G. 1958. The preparation of reptile skulls. Journal of the Ohio Herpetological Society, 1:15-17.**

Describes two basic methods of preparing articulated reptile skulls. Method one involves bacterial maceration, bleaching in hydrogen peroxide, and gluing the parts. A second method involves fixing the head in formalin, bleaching in Clorox, hand picking, further bleaching in hydrogen peroxide, and allowing to dry.

213 **Hurlin, R. G. 1918. A note on the preparation of skeletons by bacterial digestion. Science, 47:22-23.**

Presents an interesting approach to cleaning skeletons by bacterial maceration. The carefully skinned and roughed out skeleton is embedded in agar which has been heated to 43-45°C and allowed to solidify around the skeleton. Maceration is over a period of ten days to several weeks when it is dissected from the medium, resulting in a clean white skeleton. This method reduces odor and lessens the risk of lost material.

214 **Iverson, S. L., and R. W. Seabloom. 1963. A rapid method for cleaning small mammal skulls. Proceedings of the North Dakota Academy of Sciences, 17:101-103.**

Describes the preparation of small mammal skulls by initially soaking them in dilute ammonium hydroxide. The skulls are then boiled briefly in 5% potassium carbonate and then submitted to a pressurized hot water washing system. A diagram of this system is included.

215 **Jakway, G. E., W. Raskin, and T. Tytle. 1970. Sodium perborate process for preparation of skeletons. Turtox News, 48:65-67.**

Details step-by-step procedure to prepare articulated skeletons of large mammals with sodium perborate.

216 **Jannett, F. J., Jr., and J. G. Davies. 1989. An inexpensive apparatus for degreasing skulls. Curator, 32(2):88-90.**

In order to clean small mammal skeletons in a systematic manner, the authors designed a simple apparatus which can be used to degrease 36 skulls simultaneously in ammonia followed by rinsing in water.

217 **Jenne, E. A. 1974. Preparation of ligamental snake skeletons. Utah Herpetologists League Journal, 1:9-16.**

Not seen. Citation from Simmons, 1987 (No. 1182).

218 **Kerchoff, O. C. 1934. Maceration and degreasing. Museum News, 12:18.**

Describes the procedure used at Ward's Scientific Establishment. Large skeletons have the large bones drilled. The skeletons are placed in water for about a week, and the water changed daily to remove blood. The water temperature is then raised to 90°F and trypsin and sal soda are added. This process continues, changing the water every two to three days, until the skeletons are thoroughly macerated. The skeletons are next run through an ammonia and peroxide bath. Smaller skeletons are cleaned similarly. If additional degreasing is needed, carbon tetrachloride at 140°F is used.

219 **Kirchoff, O. C. 1934. The making of small ligamentary skeletons. Museum News, 12(2):8.**

Skeletons are initially defleshed, the long bones drilled, soaked in water a few days followed by soaking in 5% ammonia. They are then washed using a stiff brush and chlorinated lime (1 pound lime, 1/2 pound sal soda in 3 quarts water). The action of the lime is stopped by soaking in water, then the skeleton is bleached in 5% peroxide and 2% ammonia.

220 **Klein, R. 1964. Preparation of monkey skeletons using the dermestid beetle technique. American Biology Teacher, 26:426-427.**

Short article discussing preparation of articulated skeletons of vertebrates using dermestid beetles. Only general details are given.

221 **Konnerth, A. 1965. Preparation of ligamentary articulated fish skeletons. Curator, 8(4):325-332.**

The method described involves slow tedious dissection of the meat from the bones, soaking in ammonia, further picking, soaking in sodium hypochlorite, degreasing, bleaching in hydrogen peroxide, then pinning until dry.

222 **Kruse, W. A. R. 1946. How to make skeletons. Ward's Service Bulletin, 1:pages unknown.**

Not seen. Citation from Thomas, 1977 (No. 1228).

223 **Kung, K. 1988. A new preservation method for juvenile mammal skulls and bird skeletons. Guild of Taxidermists no. 18:6.**

The method outlined uses a synthetic tanning fluid (Irgatan LV Liquid by Ciba-Geigy). The author suggests tanning the tissue in juvenile bat skulls (the example given) thus stabilizing the skulls for dry storage and reducing shrinkage.

224 **Laurie, E. M. O., and J. E. Hill. 1951. Use of dermestid beetles for cleaning mammalian skeletons. Museums Journal, 51:206-207.**

Slightly modified dermestid technique using smaller isolated colonies contained in jars nine inches in diameter and four to eight inches high topped with a glass plate. Contains a few innovative tips for management of the colony. Standard cleaning with ammonia.

225 **Lucas, F. A. 1891. Notes on the preparation of rough skeletons. Bulletin of the United States National Museum no. 39. 9 pp.**

Classic work on this topic includes information on all vertebrate groups. Unfortunately many of the methods are dated and inappropriate for later improvements in skeleton preparation with beetles.

226 **Lucas, F. A. 1914. The preparation of skulls and skeletons for museum purposes. Proceedings of the American Association of Museums, 8:151-159.**

Reviews five methods of skeletal preparation with contributions from J. E. Benedict from the United States National Museum, A. Elwyn from the American Museum of Natural History, H. Holden from the Museum of Vertebrate Zoology, and R. Schmit from Dublin. Titles of the methods described are soda and oakite process, soap process, artificial digestion process, phenol and ammonia process, and the dry sand process.

227 **Lucas, F. A. 1950. The preparation of rough skeletons. American Museum of Natural History Science Guide no. 59. 20 pp.**

The first 16 pages are identical to the 1891 paper (No. 225) and should never have been reissued because the information was inappropriate at this time. Appended to this is a discussion and illustration of five variations on mammal skeletons.

228 **Luther, P. G. 1949. Enzymatic maceration of skeletons. Proceedings of the Linnean Society, London, 161:146-147.**

Details the preparation of small skeletons (in this case, mice) by use of the proteolytic enzyme papain. The specimens are roughed out, boiled for approximately ten minutes, cooled, and incubated at 37°C overnight in 1% papain/saline solution. They are again boiled for a few minutes, rinsed, bleached in hydrogen peroxide, and degreased in acetone. The resultant specimens are largely disarticulated, including the skulls.

229 **MacMahon, J. A. 1961. A technique for the preparation of turtle shells. Herpetologica, 17:138-139.**

Consists of an undesirable and poorly described method of saving whole skeletons or portion of decomposed turtles found in the field. One wonderful tidbit it contains is to place specimens in plastic bags so they don't smell.

230 **Maiorana, V. C., and L. M. Van Valen. 1985. Terrestrial isopods for preparing delicate vertebrate skeletons. Systematic Zoology, 34(2):242-245.**

A thorough discussion based on years of experience on the use of isopods to clean skeletons. Suggests that this method is superior to the use of dermestids in that articulation is better and loss of elements is kept to a minimum.

231 **Martin, R. L. 1964. Skull degreasing technique. Turtox News, 42(10):248-249.**

A minor note describing a method of removing skulls from carbon tetrachloride degreasing baths without coating them with surface grease.

232 **Mayden, R. L., and E. O. Wiley. 1984. A method of preparing disarticulated skeletons of small fishes. Copeia, 1984(1):230-232.**

Describes a method of preparing stained disarticulated fish skeletons by the use of trypsin or pancreatin. Specimens are scaled, eviscerated, the large muscle masses removed, placed in Alizarin Red and 5% potassium hydroxide until stained, cleaned in a buffered enzyme solution, and rinsed.

233 **McComb, N. W. n.d. Preparing skeletons using dermestid beetles. Connecticut Valley Biological Supply Co., Inc., Southampton, Massachusetts. 8 pp.**

A fairly good discussion of preparing a mounted articulated cat skeleton. This paper would be ideal for a high school student but is not sufficiently detailed for professional work.

234 **Miller, R. R. 1957. Utilization of X-rays as a tool in systematic zoology. Systematic Zoology, 6:29-40.**

Reviews the then current technology of X ray machines and discusses its use in systematic zoology. X rays of whole fluid specimens can be made easily, resulting in photographs of detailed skeletal anatomy without sacrificing the specimen, which is imperative should it be rare or valuable (e.g., holotype). It also can be used to study food habits, musculature, etc. In many cases, the details are better than can be obtained by clearing and staining which does not always result in adequate study specimens.

235 **Nelson, E. M. 1963. A preparation of a standard teleost study skull. Turtox News, 41(2):72-74.**

The author presents a very detailed procedure for dissecting a fish skull into its individual parts.

236 **Newton, A. 1860. Suggestions for saving parts of the skeleton of birds. Pp. 417-421, *in* Annual Report, Board of Regents, Smithsonian Institution. 448 pp.**

Possibly the first paper stressing the importance of preparing complete skeletons, or at least as much as possible when preparing a skin. Specific details are given on preparing sterna and windpipes.

237 **Ossian, C. R. 1970. Preparation of disarticulated skeletons using enzyme-based laundry "pre-soakers". Copeia, 1970(1):199-200.**

Discussion is given on the use of Biz and Axion to prepare vertebrate skeletons (mostly fish). The specimens were claimed to be undamaged but recent examination has shown this to be untrue.

238 **Palmieri, J. R. 1968. The preparation of bird and mammalian skulls. Carolina Tips, 31:21-22.**

Not seen. Citation from Thomas, 1977 (No. 1228).

239 **Pecina, P., and J. Porkert. 1975. *Nauphoeta cinerea* as a resort to preparation of skeletons and skulls of medium-sized vertebrates. Lynx, n.s. 17:76-78.**

Not seen. Citation from Piechocki, 1986 (No. 082).

240 **Patterson, R., and B. H. Brattstrom. 1971. Preparing herp skeletons. American Biology Teacher, 33:554.**

Minor note suggesting and describing how Biz and Clorox can be used to prepare skeletons from old formalin-preserved specimens of amphibians and reptiles.

241 **Rhodin, S. D., P. G. Haneline, and A. G. J. Rhodin. 1976. Skeletal preparation of herpetological specimens. Herpetological Review, 7(4):169-170.**

Discusses preparation of skeletal material by hand cleaning most of the skeleton followed by a brief (1-4 minute) immersion into full strength Clorox. The specimen is then neutralized in alcohol, again hand picked and, if not clean, the procedure repeated. Though the authors acknowledge that bone material is damaged by Clorox, they continue to advocate its use, even for fresh material.

242 **Roberts, A. 1964. The preparation and use of mammal skeletal materials for the science classroom. American Biology Teacher, 26:416-425.**

General summary of methods of acquisition of vertebrate specimens and preparation as articulated skeletons and their use in high school education. Skeletons are cleaned by simmering in sodium hydroxide and brushing, followed by bleaching in hydrogen peroxide.

243 **Roche, J. 1954. French.**

244 **Russell, W. C. 1947. Biology of the dermestid beetle with reference to skull cleaning. Journal of Mammalogy, 28:284-287.**

A classic work on the life cycle of dermestid beetles and tips on maintaining a colony and cleaning skeletons.

245 **Sanders, O. 1953. A rapid method for preparing skeletons from preserved salientia. Herpetologica, 9(1):48.**

Proposes that frog skeletons be cleaned by skinning, defleshing as far as possible, and dissolving the rest of the tissue with household Clorox or Purex (sodium hypochlorite). The author does state that bones left too long in the solution may become completely decalcified and crumble.

246 **Scarborough, T. J., and R. H. Green. 1986. The preparation of osteological material with the aid of insects. Pp. 101-105, *in* 1986 Pacific Preparators Conference, Queen Victoria Museum and Art Gallery, Launcetown, Tasmania. 105 pp.**

Gives a good description of the entire process of cleaning skeletons with dermestid beetles, from set up of the colony, to maintenance and cleaning. The results are good but output per year is small (about 100 small to medium specimens).

247 **Scharff, R. F. 1911. On a dry system of macerating bones. Museums Journal, 10(7):198-200.**

Describes a method of skeleton preparation by dry maceration of carcasses buried in a specially constructed pit filled with sand. No offensive odors emanated from the pit during the average time of ten months maceration per specimen.

248 **Scheffer, V. B. 1940. A tip on cleaning mammal skulls with the aid of dermestid beetles. Murrelet, 21:10.**

Suggests the use of small paper cups thumbtacked to a board as containers for skulls while in the dermestid colony.

249 **Schmitt, D. M. 1966. How to prepare skeletons. Ward's Curriculum Aid, Ward's Natural Science Establishment, Rochester, New York. 8 pp.**

Excellent description of preparation of skulls and ligamentary skeletons by chemical means (ammonia, sodium hypochlorite, and hydrogen peroxide). Better description of mounting than most articles on this subject.

250 **Sealander, J. A., and R. G. Leonard. 1954. Use of crayfish for cleaning skeletal material. Journal of Mammalogy, 35:428-429.**

This novel method is adequately described but no solution could be found for some of the problems encountered in its use.

251 **Sherman, H. B. 1925. A degreasing apparatus. Journal of Mammalogy, 6(3):182-184.**

Discusses a machine which is quite similar to the vapor degreasers of today. Applicable to cleaning osteological specimens.

252 **Simmons, J. E. 1986. A method for preparation of anuran osteological material. Pp. 37-39, *in* Proceedings of the 1985 Workshop on Care and Maintenance of Natural History Collections (J. Waddington and D. M. Rudkin, eds.) Royal Ontario Museum Life Sciences Miscellaneous Publications. 121 pp.**

Describes the preparation of skeletons of frogs and toads by careful dissection of bones from the fresh or preserved specimen. Advocates final cleaning using sodium hypochlorite.

253 **Sommer, H. G., and S. Anderson. 1974. Cleaning skeletons with dermestid beetles -- two refinements in the method. Curator, 17:290-298.**

The system used by the American Museum of Natural History is outlined with emphasis on the use of a cotton bed in the dermestid enclosure. Details on using spot applications of formalin to prevent disarticulation of certain bones while in the colony are also given.

254 **Storer, R. W. 1988. Preparation of bird skeletons. Bird Collection Newsletter, 1:1-5.**

A recent article describing the methods used at the Museum of Zoology. Skeletons are cleaned with dermestids, then simmered in very weak detergent. Good summary of the process with some useful and unique tips.

255 **Thompsett, D. H. 1958. The preparation of skeletons. Museums Journal, 57:282-287.**

This is a very well-written article on the preparation of articulated skeletons using warm water maceration. The author includes much information on this subject which is not available elsewhere.

256 **Thompson, M. P., and R. J. Robel. 1968. Skeletal measurement and maceration techniques for aging bobwhite quail. Journal of Wildlife Management, 32:247-255.**

Contains little information on preparation, but a discussion is given on the use of timed maceration for aging skeletons.

257 **Tiemeier, O. W. 1939. The dermestid method of cleaning skeletons. University of Kansas Science Bulletin, 26:377-383.**

Excellent early discussion of running the dermestid colony at the University of Kansas. Many observations valid today.

258 **Tiemeier, O. W. 1950. The os opticus of birds. Journal of Morphology, 86:25-46.**

This is the classic work on this topic. Illustrates the amount of information that can be obtained from a simple obscure bone.

259 **Timm, R. M. 1982. Dermestids. Field Museum of Natural History Bulletin, 53(2):14-18.**

A fascinating popular article showcasing the value of a dermestid colony. Many illustrations including scanning electron microscope photos.

260 **Torres, H. 1972. Spanish.**

261 **Valcarcel, A., and D. L. Johnson. 1981. A new dermestid repository for skeleton preparation. Curator, 24:261-264.**

Design is given for a "beetle box" on wheels, approximate dimensions 100 x 70 x 60 cm, which functions well and is much cheaper than bug rooms or walk-in chambers.

262 **Vestjens, W. J. M., A. H. D'Andria, and G. F. van Tets. 1975. Notes on the preparation of osteological specimens. Commonwealth Scientific and Industrial Research Organization (CSIRO), Division of Wildlife Research, Technical Memorandum, 10:1-16.**

Outlines the various methods of skeleton preparation with tips on maceration; boiling; use of ants, flies, and dermestids; cleaning; and storage. Figure 1 reproduces an excellent bird skeleton data sheet.

263 **Vorhies, C. T. 1948. A chest for dermestid cleaning of skulls. Journal of Mammalogy, 29:188-189.**

Good description of an alternative-style bug colony in Arizona kept in a metal box with approximate dimensions of 2 x 3 x 1.5 ft. Suggests different species of dermestids may be advantageous for varying needs.

264 **Wiles, I. A. 1932. A method for the disarticulation of skull bones. Science, 75:516-517.**

Describes a method for disarticulating medium-sized mammal skulls by filling the skull cavity with gelatin or agar and freezing, which exerts steady pressure on the sutures so that individual elements are easily separated.

265 **Williams, S. L., and S. P. Rogers. 1989. Effects of initial preparation methods on dermestid cleaning of osteological material. Collection Forum, 5(1):11-16.**

Reports on tests to evaluate various methods of initial preparation of material on the cleaning efficiency of dermestid beetles. Eight methods were evaluated using various regimes of drying, storing in fluid solutions (formalin and alcohol), soaking in water, and soaking in ammonia.

266 **Williams, S. L., and M. Smolen. 1981. Building a beetle colony. Carnegie Magazine, 55(3):22-23.**

Details travel to a bat cave in Texas to obtain dermestids to stock a dermestid colony housed in a new environmental chamber. While there, 1500 skeletal specimens were cleaned in four days by the large cave colony.

267 **Wood, D. S., and M. A. Jenkinson. 1984. World inventory of avian anatomical specimens: geographical analysis. American Ornithologists' Union and Oklahoma Biological Survey, Norman, Oklahoma. 290 pp.**

Breaks the world into 60 areas, summarizes the total skeletons and spirit specimens known for each species, and then lists areas in which each species exists. This is a valuable reference for field collectors in that if a trip is planned for a particular area, an examination of this publication would illustrate gaps in anatomical material from the area to be collected.

268 **Wood, D. S., and G. D. Schnell. 1986. Revised world inventory of avian skeletal specimens. American Ornithologists' Union and Oklahoma Biological Survey, Norman, Oklahoma. 296 pp.**

Computer printed inventory of 103 skeleton collections around the world, including almost all major collections. The total is just over 327,000 complete or partial skeletons.

269 **Wood, D. S., R. L. Zusi, and M. A. Jenkinson. 1982*a*. Inventory of avian skeletal specimens. American Ornithologists' Union and Oklahoma Biological Survey, Norman, Oklahoma. 224 pp.**

Initial computer printout of 89 skeleton collections listing the number of skeletons for each recognized species of bird. Replaced by Wood and Schnell, 1986 (No. 268).

MANUSCRIPTS

270 **Anonymous. n.d. Preparation of a ligamentary skeleton. 7 pp. (Copy at Carnegie Museum of Natural History.)**

Recent paper (since 1976) discussing various points on maceration, use of papain, and the perborate method.

271 **Anonymous. 1929. Suggestions for cleaning skulls and skeletons of vertebrates. California Museum of Vertebrate Zoology, Berkeley, California, 2 pp.**

Short paper giving basic details covered in later papers by Hall and Russell.

272 **Anonymous. 1931. Preparation of osteological specimens. Museum of Vertebrate Zoology, Berkeley, California. 3 pp.**

Contains more information than the earlier manuscript (No. 271) on the exact procedure followed at that time.

273 **John, D. K. 1979. "Bugging" skeletons. Smithsonian Institution, Washington, DC. 3 pp.**

Small paper detailing a few observations on the United States National Museum of Natural History dermestid colony.

274 **John, D. K. 1979. A general review for laymen of the Smithsonian Institution's facilities and procedures for the preparation of skeletons from Recent zoological remains. Smithsonian Institution, Washington, DC. 5 pp.**

Covers the topic very well by giving a thorough overview from the importance of skeletons to cleaning, with about half of the article discussing dermestid colonies.

275 **Jones, R. E. 1970. "Bug" culture. Museum of Vertebrate Zoology, University of California, Berkeley, California. 3 pp.**

Basic article describing how to build and maintain a small dermestid colony.

276 **Jones, R. E. 1973. Untitled instructions on skeleton handling techniques at the Museum of Vertebrate Zoology. Museum of Vertebrate Zoology, University of California, Berkeley, California. 3 pp.**

In-house step-by-step procedure of flow of specimens.

277 **Remsen, J. V., Jr. (1984-5). Preparation of skeletal bird specimens. Louisiana State University Museum of Zoology, Baton Rouge, Louisiana. 2 pp.**

Short but valuable paper in that it gives good specific details on initial bird preparation with some tips not found elsewhere.

278 **Wood, D. S. 1977. General procedure for preparation of avian (or mammalian) skeletons. Stovall Museum, University of Oklahoma, Norman, Oklahoma. 12 pp.**

Very detailed description of operations at the Stovall Museum, from initial field preparation to labeling the box of the finished specimen.

V. FLUID SPECIMEN PREPARATION

This section is limited primarily to those papers dealing with preparation and management of fluid specimens of birds and mammals. The reader is referred to Division XXXIII, Preparation and Collection Management of Lower Vertebrates, for further information relevant to fluid specimens.

279 **Anonymous. 1959. Preserving zoological specimens -- narcotization, fixation, and preservation. Turtox Service Leaflet, 2:1-4.**

Not seen. Citation from Thomas, 1977 (No. 1228).

280 **Anonymous. 1959. Preparation, injection, and care of embalmed specimens. Turtox Service Leaflet, 21:1-4.**

Not seen. Citation from Thomas, 1977 (No. 1228).

281 **Berger, A. J. 1956. Further notes on alcoholic specimens. Auk, 73:452.**

Gives instructions for the shipment of alcoholic specimens in polyethylene bags by first wrapping with cotton and then boxing. Also publishes a formula for neutral formaldehyde for long term preservation which the author suggests is better than alcohol for histologic work.

282 **Burton, P. J. K. 1969. Two bird specimens probably from Cook's voyages. Ibis, 111:388-390.**

Consists of a lengthy discussion of the history of these two specimens which were probably about 190 years old and may well be the oldest bird specimens in fluid. Their reasonably good shape attests to the longevity of this type of preservation.

283 **Cannell, P. F., M. R. Bakst, and C. S. Assa. 1988. Suggestions regarding alcoholic bird collections. Condor, 90:500-503.**

This paper is a result of an attempt at examination of gross anatomy and histology of 13 fluid specimens. Of these, none were suitable for study. The rest of the paper points out the requirements for good fluid specimen collections and their stability -- increased supply and series, speed in fixation, accurate documentation, and adequate conservation.

284 **Fort, W. B., H. C. Wilson, and H. G. Goldreme. 1941. The daily removal of formalin from preserved biological specimens used in classwork. Science, 94(2433):169-170.**

Reports on a method of eliminating the formalin odor (and theoretically much of the surface formalin) by immersing the specimens for a period of 3-5 minutes in a 5.7% (by weight) solution of sodium bisulfite ($NaHSO_3$) buffered with 3.8% (by weight) sodium sulfite (Na_2SO_3) in tap water.

285 **Huheey, J. E. 1963. Concerning the use of paraformaldehyde as a field preservative. Copeia, 1963(1):192-193.**

Describes an improved method for mixing paraformaldehyde in the field by using sodium carbonate instead of heat or sodium hydroxide. Also gives a recipe for AFA solution using trioxane, acetic acid, and ethanol.

286 **Jones, E. M., and R. D. Owen. 1987. Fluid preservation of specimens. Pp. 51-63, in Mammal Collection Management, (H. H. Genoways, C. Jones, and O. L. Rossolimo, eds.), Texas Tech University Press, Lubbock, Texas. iv + 219 pp.**

Examines the historical background of fluid preservation, current preservation techniques and use of specimens, with some future considerations. The sections on

preservation and storage are well researched and clearly written. Contains 29 citations in the literature cited section.

287 **Kannemeyer, S. 1973. The storage of a wet collection. South African Museums Association Bulletin, 10(7):274-277.**

Suggests that museum personnel investigate the use of the new Grathwol fluid specimen jar with a snap-on lid for small specimens. Also reports on a system for storage of large specimens in specially designed wooden tanks lined with fiberglass. The specimens are hung in plastic envelopes containing holes for fluid passage (and drainage when removing for examination) and the catalogue number is placed on the plastic hanger for easy retrieval in a full vat.

288 **Levi, H. W. 1966. The care of alcoholic collections of small invertebrates. Systematic Zoology, 15(3):183-188.**

Discusses the fine details of fluid specimen storage, the types of jars and lids, and tape and other sealants. Also describes various preservatives, reclamation of dried specimens, and label making.

289 **Miller, R. R. 1952. Treated formalin as a permanent preservative. Turtox News, 30:178-179.**

Many specimens stored for long periods in formalin are ultimately damaged in this extremely acidic fluid which decalcifies bones, hardens soft parts, and blackens specimens. The author suggests that adding a teaspoon of borax per half gallon of 10% formalin maintains a pH of 8.8 and allows long-term storage.

290 **Parker, G. H., and R. Floyd. 1895. The preservation of mammalian brains by means of formal and alcohol. Anatomischer Anzeiger, 49(4).**

Reports on the use of a mixture of 4 parts 2% formalin and 6 parts 95% alcohol to fix brain tissue of sheep. This contribution from the Zoological Laboratory of the Museum of Comparative Zoology at Harvard is certainly among the first uses of formaldehyde in the United States.

291 **Penrith, M. J. 1971. Notes on new products of interest to curators of wet collections. South African Museums Association Bulletin, 9(14):499-507.**

Suggests five new preservatives which should be tested against formaldehyde and alcohol because of the many disadvantages of these commonly used chemicals. Also discusses various types of labels, vials, jars, and large containers.

292 **Pope, P. H. 1928. Isopropyl alcohol as a preservative. Science, 68:487-488.**

Reports on examination of five salamanders stored for six years at 40, 50, 60, 70, and 80 percent isopropyl. The low concentrations worked well for preservation but much of the yellow color was removed. At high concentrations the specimens were stiff and shrunken and had other bad properties. Suggests that a low concentration isopropyl may be a good substitute for ethyl alcohol.

293 **Quay, W. B. 1974. Bird and mammal specimens in fluid -- objectives and methods. Curator, 17(2):91-104.**

A now classic paper discussing in detail the fixation and preservation of specimens from a microanatomical and histological standpoint. Details are given for perfusion of specimens, and mixing a 10% neutral buffered formalin solution. Seven plates provide examples of histological work that can be performed on properly prepared fluid specimens.

294 **Rau, R. 1971. The preparation of specimens for wet collections. South African Museums Association Bulletin, 9:589-592.**

Discusses the proper procedures for preparation of fluid specimens of vertebrates: various means of killing, injection through the anus/cloaca (with a mixture of 100 parts of 70% alcohol and 5 parts of 38% formalin), and proper positions for the various groups. One useful tip given is to store specimens undergoing fixation in a refrigerator.

295 **Schultz, A. H. 1924. Preparation and preservation of anatomical and embryological material in the field. Journal of Mammalogy, 5:16-24.**

Details are given for preparation of larger mammals as fluid specimens by embalming (perfusing) into an artery with a glass or metal cannula. Recommendations are also given for injecting colored matter into vessels and for preservation of embryos and fetuses.

296 **Smith, J. L. B. 1947. A neutral solution of formaldehyde for biological purposes. Transactions of the Royal Society of South Africa, 31(3):279, 282.**

Advocates the use of hexamine or ammonia to create a neutral solution for biological purposes. Both function well to buffer formaldehyde solutions which become acidic over time without a buffer and result in damage to specimens.

297 **Taub, A. M. 1962. The use of paraformaldehyde as a field preservative. Copeia, 1962(1):209-210.**

Minor note describing the use of paraformaldehyde and a small amount of the catalyst sodium hydroxide in boiling water to prepare a formaldehyde solution.

298 **Taylor, W. R. 1977. Observations on specimen fixation. Proceedings of the Biological Society of Washington, 90(4):753-763.**

Comparison of glutaraldehyde and formalin as fixatives, with and without buffers. Suggests that powdered limestone works well as a buffer and prevents loss of bony tissue. Notes that further work may be needed but that a mixture of glutaraldehyde and formaldehyde resulted in better specimen preservation than either one alone.

299 **Waller, R., and D. E. McAllister. 1985. A spot test for distinguishing formalin from alcohol solutions. Pp. 93-99, *in* Proceedings of the 1985 Workshop on Care and Maintenance of Natural History Collections (J. Waddington and D. M. Rudkin, eds.) Royal Ontario Museum Life Sciences Miscellaneous Publications. 121 pp.**

See following citation.

300 **Waller, R., and D. E. McAllister. 1987. A spot test to distinguish formalin from alcohol solutions. Curator, 30(3):240-249.**

Describes how to make a simple and inexpensive paper test strip which will distinguish between a formalin-based fixative/preservative solution and an alcohol-based preserving solution containing only traces of residual formalin. Discusses ramifications of the test and effects of buffers and other chemicals which do not seem to interfere with its reliability.

301 **Wood, D. S., R. L. Zusi, and M. A. Jenkinson. 1982*b*. Inventory of avian spirit specimens. American Ornithologists Union and Oklahoma Biological Survey, Norman, Oklahoma. 181 pp.**

Presents inventory totals for 41 collections around the world, including most, if not all, of the major collections. The total is just over 105,000 fluid specimens. Unfortunately, no measure of the quality or age of specimens is included (see

Cannell *et al.*, 1988, No. 283). It is possible that only one half or less of the total specimens represented are suitable for dissection.

302 **Woodburne, R. T., and C. A. Lawrence. 1952. An improved embalming fluid formula. Anatomical Record, 114:507-514.**

Reports on a study testing seven new formulas for embalming fluids against the standard ethanol-glycerine-formalin-phenol-water mixture. The proposed formula is significantly cheaper, attains the same or better results, and is composed of isopropanol, glucarine B, formalin, phenol, benzalkonium chloride, and water.

MANUSCRIPTS

303 **Boulton, R. n.d. The preservation of nestling birds for study. Typewritten instructions made for Chicago Field Museum. 6 pp.**

Describes preservation of birds (especially Passeriformes) for studies in pterylosis using 2- to 4-day-old nestlings. The specimens remain for from four to six hours in the fluid which is comprised of 2 cc of 40% formaldehyde and 98 cc of 70% ethanol. They are then transferred to the preserving fluid made up of 70% ethanol containing 5% glycerine, which prevents the specimen from hardening and shriveling. The collector must at the time of collection identify the specimen and/or also collect the parent(s), and record all data and cross index labels.

304 **Ehmann, H. n.d. Neutralized "dry" formalin solution. Department of Herpetology, The Australian Museum, Sydney. 2 pp.**

Gives the formula for an improvement on the Huheey, 1963 (No. 285) paper for mixing paraformaldehyde with sodium carbonate. Citric acid is added at 5.17 g/500 ml of finished solution. This brings the pH of 12 down to approximately 6.4 (with good buffering capacity to pH of 7.2).

305 **Remsen, J. V., Jr. n.d. Preparation of fluid-preserved bird specimens. Louisiana State University Museum of Zoology, Baton Rouge, Louisiana. 1 pp.**

Concise description of the preparation of pickled birds with many notable precautions for the preparation of good specimens.

SEE ALSO

Berger, 1955 (No. 167).
Wood and Jenkinson, 1984 (No. 267).

VI. EGGS AND NESTS

There have been very few recent publications on preparation and management of egg collections. Most of the literature is quite old, published at a time when every schoolboy was encouraged to make a collection of bird eggs. A number of these early publications are cited below. The more recent papers deal with various aspects of eggs -- new methods to measure incubation stage, calculating egg volumes, etc. A representative sampling of these papers appears below.

306 Agnew, N. 1981. The corrosion of egg shells by acetic acid vapor. ICCM Bulletin, 7(4):3-9.

During routine maintenance of egg collections in the Queensland Museum, a destructive white efflorescence was noticed on certain eggs. Identification and later testing showed the cause to be acetic acid, probably from vapors emanating from the wood in the storage cabinets. The author suggests wooden cabinets or drawers not be used in egg collections or other collections containing carbonate minerals such as shells.

307 Anderson, D. W., and J. J. Hickey. 1972. Eggshell changes in certain North American birds. Pp. 514-540, *in* Proceedings of the XV International Ornithological Congress. 745 pp.

Representative study of the change in thickness of egg shells as a result of chemical pollution. Summarizes data for a large number of species and contains a thorough bibliography.

308 Bancroft, G. 1929. Notes on oometry. Condor, 31:157-159.

Describes and provides instructions for making an instrument to measure eggs.

309 Bendire, C. 1891. Directions for collecting, preparing and preserving birds' eggs and nests. Bulletin of the United States National Museum no. 39, P+D. 10 pp.

The classic paper for this subject. Includes directions for blowing eggs, both fresh and those with developing embryos; and information on packing, shipping, labeling, and data management for eggs. The information on nests is of little value.

310 Bergtold, W. H. 1929. Egg weights from egg measurements. Auk, 46:466-473.

Probably the first attempt at calculating weights of eggs from measurements.

311 Bowdish, B. S. 1930. Collecting nests. Oologist, 48(12):152-153.

Suggests placing tissue paper (never cotton) in the nest cavity and winding only the loosely constructed nests with similarly colored silk thread. Recommends personnel keep meticulous records on nest location data and set characteristics with cross referencing on the data slips.

312 Brewster, E. E. 1895. Apparatus for preparing birds' eggs. Auk, 12:196-198.

Describes and illustrates a simple aspirator which functions to suck out the contents of eggs using flowing water to create the vacuum.

313 Congreve, W. M. 1948. On preparation and data. Part I. The Oologist's Record, 22:49-55.

Consists of the ramblings of a dedicated European oologist with a few minor tips on preparation of eggs and nests.

314 **Congreve, W. M. 1949. On preparation and data. Part II. Oologist's Record, 23:19-28.**

Continued ramblings, this time preaching the necessity of a catalogue, a data slip stored with the eggs, and the marking of eggs. Important data include reference number, set mark, number in set, incubation, identification, date, locality, nest and/or notes, collector, and species.

315 **Green, H. O. 1928. A review of oological methods. Oologist, 45(3):26-29.**

The author investigated all available ornithological magazines, egg catalogues, manuals of taxidermy, general works on ornithology, etc., for the previous fifty years and wrote a popular account of the variety of methods used to collect, prepare, and store eggs.

316 **Grinnell, J. 1906. Is egg-collecting justifiable? Condor, 8:155-156.**

Response to an article in *Bird-Lore* which indicated that the bulk of egg-collecting is useless. Grinnell argued that the science of oology may add a great deal of information to the sum total of scientific knowledge of birds.

317 **Hays, H., and M. LeCroy. 1971. Field criteria for determining incubation stage in eggs of the common tern. Wilson Bulletin, 83(4):425-429.**

Results are given of a study to determine the incubation stage of the eggs of the common tern. Eggs were collected at various stages, floated in water, followed by removal and preservation of the embryos. Characteristics of the eggs and the developing embryos were described for nine two-day intervals.

318 **Hemphill, F. A. 1936. Preparation of eggs. Oologist, 53(8):108-111.**

An in-depth description of one method of egg preparation. After hand blowing with a blowpipe, the egg is injected with a weak solution of ordinary peroxide, allowed to sit overnight, and then rinsed again. Also offers tips on drying hard-to-dry specimens, and preparing slightly incubated eggs, among other techniques.

319 **Hiller, A. 1972. A technique for repairing birds' eggs. Kalori, no. 44:24-26.**

Describes a method for the repair of cracked bird eggs. The egg is first soaked in warm water to relax the membrane. Then sections that can be moved back to alignment are set with self-adhesive paper strips. When the sections are separated, thin fiberglass mat is first attached in small strips to one piece. Then this section (and the others previously) can be painted with soluble nylon and attached. The egg inside can then be sealed with a layer of nylon solution through the blowhole.

320 **Horvath, L. 1957. Hungarian.**

321 **Hoyt, D. 1979. Practical methods of estimating volume and fresh weight of bird eggs. Auk, 96:73-77.**

Recent paper discussing formulas for estimating egg volume by linear measurements of eggs. The proposed formula was tested by filling 210 eggs from 26 species with water. Correlations with measurements indicated egg weight could be calculated to within 2% of the fresh weight.

322 **Ingersoll, E. 1882. Bird nesting: A handbook of instruction in gathering and preserving the nests and eggs of birds for the purposes of study. Salem, Massachusetts. 110 pp.**

Excellent older book giving information on field work, preparation of specimens, organization of the cabinet, and other miscellaneous tips.

323 Jourdain, F. C. R. 1932. Remarks on measuring bird eggs. Bulletin of the British Ornithologists Club, 52:128-129.

Minor note about reporting sizes of eggs in the literature.

324 Kennard, F. H. 1921. Moulds and bacteria on egg collections. Auk, 28:345-356.

A somewhat lengthy discourse on molds and bacteria found on a private collection of eggs and attempts to clean them. A number of remedies were suggested as well as some recommendations for storage of eggs.

325 Kennard, F. H. 1928. A method of blowing eggs. Auk, 45:234-236.

Details an aspirator simpler than that of Brewster (No. 312) for sucking out the contents of eggs. Also suggests use of pepsin as a digestive to facilitate the removal of partially incubated embryos.

326 Kiff, L. F., and D. J. Hough. 1985. Inventory of bird egg collections of North America. American Ornithologists Union and Oklahoma Biological Survey, Norman, Oklahoma. 259 pp.

Inventory includes 72 North American collections which house 463,000 sets or about 93% of the sets known to exist. A world survey of egg collections is now being conducted.

327 Klaas, E. E., H. M. Ohlendorf, and R. G. Heath. 1974. Avian eggshell thickness: variability and sampling. Wilson Bulletin, 86:156-164.

Egg shell thickness of various sets of five species of birds was measured and it was found that variability within clutches was almost as great as variability between clutches. Regarding new collecting, the authors suggest that entire clutches be taken rather than individual eggs or partial clutches to reduce variability.

328 Loftin, R. W., and R. D. Bowman. 1978. A device for measuring egg volumes. Auk, 95:190-192.

Presents an improvement upon the graduated cylinder/water displacement method for estimating egg volumes. An egg volumeter was constructed of a plastic water reservoir with two attached burets. While in the horizontal position, an egg is admitted to the filled reservoir and the unit righted. The total volume is then compared to the that of the reservoir without the egg. Measurements of larger eggs were very precise (0.5% SD), but not of smaller eggs (+/- 2%).

329 Morris, R. D., and F. W. Chardin. 1986. A device for measuring the volume of eggs: description and field evaluation. Ibis, 128:278-284.

Describes and illustrates a device using a piston assembly and a burette to measure egg volume by water displacement. The device field tested well in a mock study of gull eggs.

330 Newton, A. 1860. Suggestions for forming a collection of birds' eggs. (Reprinted, with additions, from the Circular of the Smithsonian Institution of Washington.) Zoologist, 18:7189-7201.

An early paper by one of England's leading naturalists describing collection, preparation, and shipment of eggs. Interesting for historical reasons.

331 Prynne, M. 1963. Egg-shells. Barrie and Rockliff, London. 304 pp.

Not seen. Citation from Macbeth and Strohlein, 1965 (No. 1193), who described it as an informal dissertation on birds' eggs in every aspect, including the repair and care of eggs.

332 **Rahn, H., C. V. Paganelli, and A. Ar. 1975. Relation of avian egg weight to body weight. Auk, 92:750-765.**

A largely statistical paper analyzing the relationship between egg and body weight for over 800 species of birds with plots on orders and a number of families. Contains no preparation information, but illustrates one type of study that can result from cumulative records of basic weight data.

333 **Rockwell, R. B. 1908. Some hints on the preparation of an oological collection. Condor, 10:86-90.**

Discusses organization and management of an egg collection including cabinets, boxes, labels, bedding materials, and data blanks.

334 **Spencer, J. L., and W. C. Kennard. 1956. Preservation of birds' nests with plastic spray. Auk, 73:280.**

Minor note describing preservation of nests by spraying the fumigated dry nest with several coats of plastic spray. The method worked well on a wide variety of nests, but no mention is made of its long term effect, or the possible effect on future study of the nests.

335 **Treganza, A. O., and A. Treganza. 1916. Preparation of oological specimens from field to cabinet. Oologist, 33(3):44-50.**

Discusses various aspects of egg collection and preparation with instructions for making a collecting box for transfer of eggs from the field prior to preparation, as well as tips on blowing eggs including those which have been heavily incubated.

336 **Vaisanen, R. A. 1978. Why measure eggs of birds? A review. Anser Supplement, 3:247-252.**

Not seen. Citation from R. James.

337 **Van Paasen, A. G., D. H. Veldman, and A. J. Beintema. 1984. A simple device for determination of incubation stages in eggs. Wildfowl, 35:173-178.**

Describes an improvement in a method to measure the incubation stage of unhatched eggs. Utilizing the principle that dehydration of eggs by evaporation is essentially constant, the authors developed an "incubometer" to measure the various stages of floating by measuring the angle the egg makes from the horizontal plane.

338 **Weller, M. W. 1956. A simple field candler for waterfowl eggs. Journal of Wildlife Management, 20:111-113.**

Reports on a simple device to determine incubation stage of eggs. A paper mailing tube is held up to the eye and pointed at the sun, with the egg at the end, long axis perpendicular to the tube. The embryo, yolk, circulatory system, opaque areas, and air sac, are sufficiently visible for easy delineation of stages.

339 **Wells, G. 1925. On the use of arsenic in the preserving of birds' nests. Oologist, 42(10):141.**

In order to prevent damage by vermin, bugs, and moths to nests containing especially fur, hair, wool, and feathers, the author liberally placed arsenic in the nests using an ordinary pepper shaker for sprinkling. If this practice was widespread, current workers should use extreme caution when handling nests.

MANUSCRIPTS

340 **Kiff, L. F. 1978. Instructions for the preparation and shipment of eggshell specimens. Western Foundation of Vertebrate Zoology, Los Angeles, California. 7 pp.**

Excellent concise set of instructions drawn up by an authority on eggs and egg collections.

VII. CLEARING AND STAINING OF SPECIMENS

The majority of papers in this section pertain to clearing and staining of amphibians, reptiles, and fish, where this method is commonly used to observe skeletons, cartilage, and other systems. In birds, clearing and staining is used primarily for embryo or nestling study. Many of the citations are unannotated because of inability to easily obtain copies of the papers and the senior author's lack of expertise in this area.

341 Bock, W. J., and C. R. Shear. 1972. A staining method for gross dissection of vertebrate muscles. Anatomischer Anzeiger, 130:222-227.

342 Burdi, A. R. 1965. Toluidine Blue - Alizarin Red S staining of cartilage and bone in whole-mount skeletons *in vitro*. Stain Technology, 40:45-48.

343 Campbell, S. C. 1986*a*. A method for clearing and staining small fishes, amphibians and reptiles. Pp. 29-32, *in* Proceedings of the 1985 Workshop on Care and Maintenance of Natural History Collections (J. Waddington and D. M. Rudkin, eds.), Royal Ontario Museum Life Sciences Miscellaneous Publications. 121 pp.

Adaptation of enzyme method introduced by Taylor, 1967*a* (No. 362).

344 Campbell, S. C. 1986*b*. A bibliography of clearing and staining small vertebrates. Pp. 115-116, *in* Proceedings of the 1985 Workshop on Care and Maintenance of Natural History Collections (J. Waddington and D. M. Rudkin, eds.), Royal Ontario Museum Life Sciences Miscellaneous Publications. 121 pp.

Fairly complete bibliography which includes 61 references on this subject.

345 Cumley, R. W., J. F. Crow, and A. B. Griffen. 1939. Clearing specimens for the demonstration of bone. Stain Technology, 14:7-11.

346 Davis, D. D., and U. R. Gore. 1947. Clearing and staining skeletons of small vertebrates. Fieldiana Technical Bulletin no. 4. 16 pp.

One of the classic papers on this subject. Uses potassium hydroxide to clear the specimens and an Alizarin Red pigment for coloring bone material.

347 Dingkerkus, G., and L. D. Uhler. 1977. Enzyme cleaning of Alcian Blue stained whole small vertebrates for demonstration of cartilage. Stain Technology, 52:229-232.

348 Evans, H. E. 1948. Clearing and staining small vertebrates, *in toto*, for demonstrating ossification. Turtox News, 26(2):42-47.

Similar paper to Davis and Gore (1947) again using potassium hydroxide to clear and Alizarin Red S to stain. Includes a section on embedding in plastic.

349 Filipski, G. T., and M. V. H. Wilson. 1984. Sudan Black B as a nerve stain for whole cleared fishes. Copeia, 1984:204-208.

350 Filipski, G. T., and M. V. H. Wilson. 1985. Staining nerves in whole cleared amphibians and reptiles using Sudan Black B. Copeia, 1985(2):500-502.

351 Freihofer, W. C. 1966. The Sihler technique of staining nerves for systematic study especially of fishes. Copeia, 1966(3):470-475.

Nerves are stained with Ehrlich's hematoxylin after clearing by using Kott method.

352 Freihofer, W. C., L. J. V. Compagno, and W. Rogers. 1977. Additional notes on the use of the Sihler technique of staining nerves of small, whole specimens of fishes and other vertebrates. Copeia, 1977:587-588.

353 **Green, M. C. 1952. A rapid method for clearing and staining specimens for the demonstration of bone. Ohio Journal of Science, 52(1):31-33.**

Large scale use of clearing and staining.

354 **Hardaway, T. E., and K. L. Williams. 1975. A procedure for double staining cartilage and bones. British Journal of Herpetology, 5(4):473-474.**

Cartilage stained with Toluidine Blue and bone with Alizarin Red S using a modified potassium hydroxide method.

355 **Humason, G. L. 1979. Animal tissue techniques. Fourth edition. W. H. Freeman & Co. San Francisco. 569 pp.**

356 **Lansdown, A. B. G. 1968. A silver impregnation-toluidine technique for the demonstration of embryonic skeletal structures in paraffin sections. Histochemie, 13:192-195.**

357 **Mayorga, H. 1965. A rapid method for clearing and staining amphibian skeletons. Journal of the Ohio Herpetological Society, 5(1):23-25.**

Personal note on the success of the method outlined by Davis and Gore (1947) with some modifications.

358 **Russell, E. L. 1973. Improved methods for staining bones of small fetuses and vertebrates in Alizarin Red S. BioScience, 23:366-367.**

Modification of the technique outlined by Davis and Gore (1947).

359 **Russell, F. E., and R. G. McCandless. 1954. Cleaning and staining the articulated skeleton in fishes. Turtox News, 32(12):222-224.**

360 **Schultze, O. 1897. German.**

361 **Simons, E. V., and J. R. Van Horn. 1971. A new procedure for the whole-mount Alcian Blue staining of chicken embryos, adapted to the clearing procedure in potassium hydroxide. Acta Morphologica Neerlando-Scandinavica, 8:281-292.**

One of the first papers on double staining of cartilage and bone.

362 **Taylor, W. R. 1967*a*. An enzyme method of clearing and staining small vertebrates. Proceedings of the United States National Museum, 122(3596):1-17.**

A pioneering paper substituting enzyme digestion for the alkaline maceration portion of clearing.

363 **Taylor, W. R. 1967*b*. Outline of a method of clearing tissues with pancreatic enzymes and staining bones of small vertebrates. Turtox News, 45:308-309.**

Popular article on this technique of clearing tissues.

364 **Taylor, W. R., and G. C. Van Dyke. 1986. Revised procedures for staining and clearing small fishes and other vertebrates for bone and cartilage. Cybium 1985, 9(2):107-119.**

Not seen. Citation from Curation Newsletter no. 8, June, 1986, page 5.

365 **Wassersug, R. J. 1976. A procedure for differential staining of cartilage and bone in whole formalin-fixed vertebrates. Stain Technology, 51(2):131-134.**

Describes a modification of the Simons and Van Horn, 1971 (No. 361) procedure.

366 Watson, A. G. 1977. *In toto*. Alcian Blue staining of the cartilaginous skeleton in mammalian embryos. Anatomical Record, 187:743.

367 Williams, T. W. 1941. Alizarin Red S and Toluidine Blue for differentiating adult or embryonic bone and cartilage. Stain Technology, 16(11):22-25.

368 Zug, G. R., and R. I. Crombie. 1970. Modifications of the Taylor enzyme method of clearing and staining for amphibians and reptiles. Herpetological Review, 2(3):49-50.

SEE ALSO

Cannell, 1988 (No. 283).
Hildebrand, 1968 (No. 201).

VIII. SPECIAL PREPARATIONS OF BIRDS

This division includes all unique scientific preparations of birds which cannot easily be classified into a major division (study skin, skeleton, or fluid specimens). These papers are often of narrow focus but can be of immense value to systematists and other researchers, thus preparators should be aware of these techniques. Of particular interest are the papers dealing with combination specimens -- those involving skin-skeleton or skin-fluid specimens (Johnson *et al.*, 1984, No. 380; Longmore and Boles, n.d., No. 390). Also included in this section are papers describing preparation of mummies and bird parts (wings, flat skins).

369 Arctander, P. 1988. Comparative studies of avian DNA by restrictive fragment length polymorphism analysis: convenient procedures based on blood samples from live birds. Journal of Ornithology, 129(2):205-216.

Presents a convenient and simple technique for low cost sampling and preservation of DNA from live birds during field work by collecting blood. This system allows sampling during banding studies and even endangered species, without sacrificing the bird. Makes collecting large samples feasible. The paper also emphasizes that museums should build collections of avian DNA.

370 Bakken, G. S., W. A. Buttemer, W. R. Dawson, and D. M. Gates. 1981. Heated taxidermic mounts: a means of measuring the standard operative temperature affecting small animals. Ecology, 62(2):311-318.

A mostly theoretical paper on the procedure of using a taxidermy mount of a Goldfinch, Carduelis tristis, to obtain a measure of the heat required to maintain endothermy in order to construct thermal energy budgets.

371 Bakken, G. S., D. J. Erskine, and W. R. Santee. 1983. Construction and operation of heated taxidermic mounts used to measure standard operative temperature. Ecology, 64(6):1658-1662.

Describes slight improvements on the system and the actual details of heated thermal taxidermy mounts referred to in the preceding paper.

372 Cannell, P. F. 1988. Techniques for study of avian syringes. Wilson Bulletin, 100(2):289-293.

Describes procedures to dissect out the syrinx from a bird. Comments on osteological preparations of this area and presents detailed information on muscle staining, and clearing and staining for cartilage and bone.

373 Dessauer, H. C., and M. S. Hafner (comps. and eds.) 1984. Collections of frozen tissues. Value, management, field and laboratory procedures, and directory of existing collections. Association of Systematics Collections, University of Kansas, Lawrence, Kansas.

374 Erritzøe, J. 1984. Danish.

375 Floyd, M. D., and G. A. Heidt. 1979. Modifications and improvements in the formax method of preparing small avian study specimens. Proceedings of the Arkansas Academy of Sciences, 33:76-77.

Gives details for preparation of small study skins of birds as dried mummies by injection of full-strength formaldehyde saturated with borax (formax). Includes an illustration of pinning and the approximate amount of formax required for various sizes of birds.

376 Grant, G. S. 1971. Removal of cranium during preparation of study skins for later ossification studies. Bird Banding, 42(1):47.

Advocates removing the cranium and attaching it to the legs of the study skin to allow for later examination.

377 Green, R. H. 1977. The preservation of bird specimens by desiccation. Kalori, no. 57:14-15.

Experiments on making mummified specimens in the early 1960s and subsequent observation of the still well-preserved specimens led to further improvement and experimentation in the method. Green gives an excellent description of his methods of drying (sometimes by the use of a freeze dryer). The birds are eviscerated and the eyes and brain removed. These areas are filled with cotton and the birds positioned and dried. Includes numerous tips on these procedures.

378 Harrison, C. J. O. 1980. A time saving method of preserving bird bodies. Bird Study, 27(4):259-261.

Describes the preservation of bodies of dead birds as dried mummies by injection of formaldehyde solution containing potassium acetate and nitrate. Gives, with good detail, the pros and cons of this type of preparation as well as tips on improving the final product.

379 Holden, P. 1972. Collecting wings, feathers and feet. Bird Life, (July-September):6-8.

Written for young student ornithologists, this article suggests making a collection of spread and closed wings, loose feathers, and feet. The purposes given besides basic study is to aid in identification and for use by artists.

380 Johnson, N. K., R. M. Zink, G. F. Barrowclough, and J. A. Marten. 1984. Suggested techniques for modern avian systematics. Wilson Bulletin, 96:543-560.

The first half of the paper addresses the collection and preservation of bird tissue samples with recommendations for field work and notes on electrophoretic methods. The second half describes three methods of making skin-skeleton preparations.

381 Norris, R. A. 1961. A new method of preserving bird specimens. Auk, 78:436-440.

Pioneering paper on the preparation of the avian flat skin-skeleton preparation. Small flat skins containing only the bones of the beak and one wing and leg were mounted on cards, with the remainder prepared in skeleton form.

382 Phillips, C. J. 1985. Field fixation and storage of museum tissue collections suitable for electron microscopy. Acta Zoologica Fennica, 170:87-90.

Reports on a study involving two methods of field fixation of mammalian tissues for suitability in transmission electron microscopy. The fixative based on trialdehyde gave excellent results.

383 Shufeldt, R. W. 1919. Balsam St. Rocco. A new biological preserving fluid. Museum Work, 1(6):179-183.

Reports on a unique method of preserving whole specimens in the dry state by first immersing them in Balsam St. Rocco overnight and then drying in warm air. The author states that these dry specimens will be preserved indefinitely and at any time later be reconstituted by soaking, whereupon they will appear as freshly killed specimens. Though only frogs were tested, the fluid was suggested to work on all vertebrate groups.

384 Sibley, C. G., and J. E. Ahlquist. 1981. Instructions for specimen preservation for DNA extraction: a valuable source of data for systematics. Newsletter of the Association for Systematics Collections, 9(3):44-45.

Gives simple instructions for preparation of vertebrate tissue and blood for DNA studies.

385 **Stapp, W. B., and J. L. Shull. 1964. Mounting birds chemically. American Biology Teacher, 26:432-434.**

Simple instructions for preserving birds as mummies by injecting with full-strength formaldehyde, pinning out to dry, and then encasing them in a tube of cellulose acetate.

386 **Vernon, D. P. 1974. Improved study skins for study in natural history museums. Kalori, no. 49:45-47.**

Possibly the first scientific paper suggesting the use of separate spread wings apart from the prepared study skin. The wings could be used for "detailed study ... aspects of size and shape of the wing, ventral and dorsal colour patterns of wing and feather shape ... moult studies ..." Also advocates preparing study skins of birds with interesting feather patterns with spread wings, tying the humeri for support.

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387 **Anonymous. n.d. Notes on flat skin preparation. Los Angeles County Museum of Natural History, Los Angeles, California. 2 pp.**

Short description on the preparation of a flat skin modified from that of Mary Clench with an illustration. In this case, no bones remain with the flat skin.

388 **Anonymous. n.d. Technique for "pelt" preparation of avian specimens. 5 pp. (Copy at Carnegie Museum of Natural History.)**

Describes the procedure of skinning a bird to prepare a flat skin containing bones in one leg and one wing. The internal organ system is placed in a wrapped square of cheesecloth, fixed in formalin, washed, and stored in 50% alcohol. The remaining carcass is then prepared as a skeleton.

389 **Heimerdinger, M. A. 1962. The preparation of flat bird skins for pterylosis studies. Peabody Museum, Yale University, New Haven, Connecticut. 6 pp.**

Classic work on preparation of bird pelts to use in the X-ray technique for studying pterylosis. Gives illustrations of the proper cuts to make this preparation and also a typical pinned out specimen.

390 **Longmore, N. W., and W. E. Boles. 1989. A method of combined skin-fluid specimen preparation. 5 pp. (Submitted)**

Details the preparation of rare specimens as round skin/fluid specimens with one set of appendages unskinned and the other set attached to the round skin. Some damage is done to the pygostyle and connections of muscles to the skin and feather groups. However, for birds whose feather colors are affected by fluid, this represents the only manner of preparing fluid specimens which allows for complete confirmation of plumage at a later time.

IX. TEMPORARY PRESERVATION OF SPECIMENS

This entire section is a compendium of papers detailing methods of temporarily preserving specimens in the field so that they may be prepared in the laboratory. Temporary preservation allows for better use of field time for collecting and data recording while saving specimens for careful preparation under ideal conditions. Unfortunately, the methods used can often have adverse effects on the specimens. (See also Division XXII, Post Mortem/Preparation Changes in Color.)

391 Anonymous. 1959. Temporary preservation of birds. South African Museums Association Bulletin, 7:159.

The method outlined is to inject formosaline (10% formalin in ordinary saline) into the head and abdominal cavity of a bird. Following this, it is wrapped in newspaper and packed in plastic bags. The specimens could remain for up to seven days in transit before preparation or storage in a freezer.

392 Booth, E. S. 1944. Temporary preservation of small mammals in the field. Journal of Mammalogy, 25(4):354-358.

Initially begins with a review of the literature on temporary preservation. The author then reports on tests of various solutions as an embalming fluid for temporary preservation. Suggests that a mixture of formaldehyde, phenol, glycerine, and water works best for injection and immersion in the field, with preparation coming months or years later.

393 Cantwell, G. G. 1930. Preparing mammal skins in the field. Journal of Mammalogy, 11:324-325.

After experimenting with a number of methods of temporary preservation, the author suggests the storage of mammal pelts in the field in a salt and alum water solution.

394 Clancey, P. A. 1956. Some temporary methods of preserving birds and mammals in the field -- their uses and their failings. South African Museums Association Bulletin, 6:206-209.

Reviews personal experiences using the two most widespread methods of temporary preservation -- those of C. B. Ticehurst, 1938 (No. 407) and J. G. Williams, 1953 (No. 410). The method heavily favored is that of John Williams which the author discusses and to which he adds his own recommendations.

395 Clark, J. L. 1937. Preservation of mammal skins in the field. Journal of Mammalogy, 18:89-92.

Advocates initial skinning of mammals; followed by dry salting, which cures the skin in 6 - 12 hours; and then storage in a solution containing 14 parts water, 4 parts salt, and 1 part alum. Suggests that bird skins can be treated in the same manner.

396 Dickerman, R. W., and B. Villa. 1964. Dry ice: a new field technique. Journal of Mammalogy, 45:141-142.

Describes construction and use of a modified Army Surplus blood chest refitted with polyurethane to function as a portable field chest containing a standard 50-pound block of dry ice. The unit was able to maintain specimens below freezing for at least seven days.

397 Dimpel, H. 1977. The field preservation of birds and mammals for scientific study collection. Kalori, no. 52:51-54.

States that very large bird and large mammal skins should be skinned and salted in the field since they are customarily tanned for storage. Small mammals are best

stored in alcohol until they can be transferred to the lab where they can be properly washed and degreased before stuffing with polyester fiber. Specimens of more than 75 g should have the main body removed but the skull left in the skin, and smaller mammals only eviscerated prior to storage in alcohol. Birds should always be prepared in the field. If impossible, they should be frozen in field refrigerators and as a last resort stored in alcohol. Discusses some aspects of color deterioration of bird and mammal specimens.

398 Disney, H. J., de S. 1979. Temporary preservation of specimens. Corella, 3(2):26-28.

Outlines the basic methods of temporarily saving a dead bird so that it may be sent to a museum. Methods discussed include immersion in alcohol or formalin, refrigeration, storage in a brine solution, dry salting the opened abdomen, and injection with a preserving fluid.

399 French, N. R., and L. E. Swenson. 1952. Liquid preservation of birds. Journal of the Colorado-Wyoming Academy of Sciences, 4(3):78-79.

A comparison of three temporary preservation liquids was made. Ten percent formalin worked adequately, 60% alcohol storage was deemed unsatisfactory, and a mixture of equal parts turpentine and 95% ethanol was best for study skins. For the tests on birds, no color change was noted in the feathers but soft part colors were bleached.

400 Hall, E. R. 1937. Deleterious effects of preservatives on study specimens of mammals. Journal of Mammalogy, 18:359-360.

Rambling discussion suggesting strongly that mammalogists stop using the salt-alum method of temporary preservation as outlined by Clark, 1937 (No. 395). Hall reports that alum or salt or both seriously affect some mammal hair pigments and therefore jeopardize the value of a scientific skin. However, he offers no empirical evidence.

401 Howell, A. H. 1937. A simple method of saving small mammals in the field. Journal of Mammalogy, 18(1):95.

Suggests an improved method of temporary preservation by skinning, coating the inside of the skin with borax, and loosely filling the bodies with newspaper. Noted that salt sometimes affects the colors of pelage.

402 Huber, W. 1930. A method of salting and preparing water bird skins. Auk, 47:409-411.

Details the temporary preservation of skinned birds by dry salting and later packing dry. Then discusses preparation of these skins by first relaxing in water, scraping the fat, and then immersing in a solution of gasoline, alcohol, and turpentine for 24 hours. Also gives directions for relaxing very old poorly made skins in order to re-make them.

403 Konrad, G. 1969. German.

404 Loomis, E. C. 1960. An embalming technique for preserving small mammals. Journal of Mammalogy, 41:389-392.

Reports on investigations conducted to evaluate temporary preservation of small mammals by injections into the bodies with the commercial embalming fluid "Trioxitone", which consists of formaldehyde, ethyl alcohol, zephiran chloride, and water. Various sizes of mammals were tested both in the lab and field with mixed results, based primarily on time of injection after death.

405 **Parker, H. W. 1870. Carbolizing birds. American Journal of Science, Series 2, 49:283-284.**

Early paper suggesting temporary preservation for a week or two by partially skinning the bird and applying carbolic acid, i.e., phenol.

406 **Sutton, D. A. 1962. A temporary preservative for small mammals. Journal of Mammalogy, 43(2):264-265.**

Reports on a study evaluating temporary preservation of small mammals with a mixture of 7-1/2 parts glycerine, 2-1/2 parts phenol, 5 parts formaldehyde, and 85 parts water. The solution worked well with no undesirable modifications of texture and fur color.

407 **Ticehurst, C. B. 1938. Preserving by injection. Ibis (14th series), 2:152-153.**

Suggests injecting small carcasses with a solution of formaldehyde (1 drop full strength to 20 drops water) for later preparation as skins. The author made good skins in England from birds collected one to four weeks earlier in Africa.

408 **Weber, C., T. Jaccoud, and A. de Chambrier. 1984. A temporary field fixing and preserving solution for ornithological collecting. Curator, 27:281-286.**

Details the temporary preservation of birds in a mixture of 2 parts phenoxetol, 2 parts formaldehyde, and 96 parts water for later preparation in the laboratory. No mention was made of adverse effects on plumage but soft part colors were better preserved in the finished skins by this method.

409 **Williams, J. G. 1949. Records of migratory birds. Hints to collectors: the temporary preservation of birds. Nature in East Africa (Nairobi), 2(1):2-4.**

Not seen but presumably the initial description of the dry salting technique described in the following paper.

410 **Williams, J. G. 1953. The temporary preservation of small birds with fine table salt. Journal of the East African Natural History Society, 22(2):74.**

Describes a simple technique for temporary preservation of small birds for at least ten days by essentially packing the abdomen, thorax, gullet, and punctured eyes with fine table salt and rolling in paper or cotton wool.

411 **Williams, J. G. 1959. The temporary preservation of bird specimens. Ostrich Supplement (Proceedings of the 1st African Ornithological Congress), 3:443-445.**

Details four methods of temporary preservation and points out their pros and cons. The methods described were injection with formaldehyde, preservation by salting, preservation in alcohol, and injection with alcohol and weak formalin. The latter method (which was preferred) is to inject 4% formalin into the abdomen and 80% alcohol into the remainder of the bird.

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412 **Sutton, G. M. n.d. Salted birdskins. Typewritten procedure. 2 pp. (Copy at Carnegie Museum of Natural History.)**

A thorough description of how to salt skinned birds for temporary preservation. Special detail is given to the method of relaxing, degreasing, and making up of the skins.

X. WASHING, DEGREASING, RELAXING, AND REMAKING OF SKINS

The methods used in washing and degreasing specimens are extremely varied and good results are often a combination of experience and choice of the right materials. Listed below are papers that explore this topic. Though many papers are out of date, their comments are worth consulting.

Also included in this section are papers describing the relaxation of specimens, which allows study skins to be relaxed and remade or mounted, and mounted specimens to be relaxed and remounted or made into study skins.

Preparators using this section should also consult Division XIX, Feather Structure and Conservation; and also Division XXII, Post Mortem/Preparation Changes in Color, which includes papers on the effects of washing and degreasing on color.

413 **Brewster, W. 1885. A new wrinkle in taxidermy. Random Notes on Natural History, 2(1):1.**

Reports that mounted birds may be relaxed to be made into skins by pouring very hot water into the internal stuffing of the mount via the abdominal area.

414 **Buckley, B. H. 1979. Degreasing water fowl skins. American Taxidermist, 12(6):6.**

The method advocated is careful manual scraping of the skin followed by at least three good washings in lukewarm water with Tide detergent. Illustrates a scraping tool made from a paring knife with notches cut into it.

415 **Clancey, P. A. 1959. Removal of old blood in bird and mammal specimens. Bulletin of the South African Museum Association, 7:65.**

Satisfactory results were obtained by swabbing the bloody areas with hot water and diluted ether soap, followed by application of trichlorethylene and fluffing with heavy magnesium carbonate. Greasy skins can be cleaned by saturating with trichlorethylene and drying in magnesium carbonate.

416 **Colby, R. A. 1975. Technique for eliminating oil and flesh problems for ducks and geese. Artisan Supply Co., New Berlin, Wisconsin. 2 pp.**

The author suggests that if excelsior liberally coated with borax is next to the skin, the fat does not need to be removed from fatty specimens. Also recommends against washing with degreasing agents as they remove the natural sheen [obviously the former suggestion is totally false].

417 **Cowley, D. 1989. The master's touch: the crucial step. Taxidermy Today, 11(2):92-96.**

Describes the preparation of bird skins for mounting by removing fat with scissors, washing in soap, rinsing, soaking in solvent, tumbling in sawdust, rubbing with borax, and drying with the reverse flow of a vacuum cleaner.

418 **Dill, H. R. 1957. To wash and clean bird skins. Museum Graphic, 9(2):31.**

Contains some good practical information on cleaning blood and grease from skins. Small birds are not washed but larger birds are washed in dish detergents (not soap). Blood is removed prior to washing by dry salting and storing or washing with salt water. Dried blood is removed from white feathers with hydrogen peroxide or oxalic acid and from other feathers with ammonia.

419 **Dill, H. R. 1959. How to relax and prepare old bird skins. Museum Graphic, 11(3):19-20.**

Describes relaxing a skin by first applying water, then cutting the stitches and removing the filling. The body cavity is then packed with wet sand containing phenol and the bird buried in wet sand overnight. Following this, the skin is

scraped and worked until flexible. Also gives tips on how the wing bones can be recreated, and the wing cord dissected out and replaced should the skin be made into a mount.

420 **Dorbush, G. R., C. D. Ankney, and D. G. Krementz. 1985. The effect of apparatus, extraction time and solvent type on lipid extractions of snow geese. Canadian Journal of Zoology, 63:1917-1920.**

This article was written primarily about a comparison of four different fat extraction chemicals and two methods. The results were pertinent to degreasing in that petroleum ether and diethyl ether were much faster in extracting fat (3-6 hours) than a chloroform-methanol mixture (7-21 hours) or a petroleum ether-chloroform-methanol mixture (36 hours).

421 **Frankowiak, R. 1963. Dirty birds. Midwest Museums Conference Quarterly, 23(4):6.**

Describes the cleaning of old and very dirty mounted birds. The birds were first air blown to remove surface dust and loosen the subsurface. They were next washed with chlorethene and dusted in sawdust or cellulose meal, tapped with a brush, reblown, and preened. Extremely dirty birds were washed with a mild detergent, dried with sawdust, and fluffed. Grease-burned birds were cleaned with white gasoline.

422 **Green, H. O. 1915. Shore bird skins. Oologist, 32(5):87-88.**

Advocates use of benzine (or gasoline) as a cleaning fluid for degreasing the inside of the skin during preparation of shore birds. Then uses benzine followed by plaster of Paris to absorb the dirt and grease on the outside.

423 **Gütebier, T. 1977. German.**

424 **Gütebier, T. 1980. Swedish.**

425 **Harrison, C. J. O. 1963. "Industrial" discoloration of house sparrows and other birds. British Birds, 56:296-297.**

As a result of washing individual feathers of House Sparrows which had very dark coloration in detergent and benzine, it was shown that the birds were actually normally colored. This leads the author to suspect some instances of melanism to be a result of "industrial melanism" due to pollution instead of evolution.

426 **Henriksen, H. C. 1968. Old specimens: something of value. Museum News, 47:20-22.**

Describes the use of old taxidermy mounts for exhibition in small museums or nature centers. Many times, the quality of taxidermy in these specimens is better than recent material. Old specimens were cleaned by first blowing the loose dirt out with an air compressor. Surface dirt was cleaned by ground styrofoam which became electrostatically charged when rubbed over the mount and attracted the dust and dirt particles. Grease was removed by cheese cloth dipped in 95% alcohol.

427 **Hofenk-De Graaff, J. H. 1968. The constitution of detergents in connection with the cleaning of ancient textiles. Studies in Conservation, 13(3):122-141.**

Discusses the various aspects of washing materials from a theoretical point of view, includes a survey of the constitution of detergents and their function in washing, and also briefly covers organic fluids. Though this paper is tailored for washing textiles, much of the information is relevant to washing animal materials (feathers, skin, hair, etc.)

428 Hornaday, W. T. 1881. How to soften dry bird skins. Wards Natural Science Bulletin, 1 & 2:12.

Good description of relaxing study skins to be made into mounts. With only slight modifications, the method could be used today.

429 Hudson, G. E. 1935. A practical method of degreasing bird skins. Auk, 52:102-103.

Advocates degreasing dried bird skins by immersing completely in several changes of gasoline over several weeks. This procedure was said to work well because gasoline penetrates a dry skin much better than a wet skin (as in Huber's cleaning solution, No. 402).

430 Hudson, H. E. 1935. A practical method of degreasing study skins. Journal of Mammalogy, 16:329-330.

Similar to preceding paper.

431 Lloyd, H. 1918. The extraction of fat from bird skins. Auk, 35:164-169.

Outlines a method of degreasing fatty and rapidly deteriorating study skins by using a modified Soxhlet extraction apparatus containing ethyl-ether. Also addresses the subject of feather color change by short term immersion in ether and found none for a whole range of colors in 15 species of birds.

432 Lloyd, H. 1929. A method of cleaning large bird skins. Canadian Field Naturalist, 42:207-208.

Suggests the use of a washing machine to clean large skins (in this case, swans) which were very dirty and perhaps contained tar or oil. Specimens were skinned and salted overnight, washed with water, placed in a washing machine with soap for a short while, rinsed in the machine three times, soaked overnight in gasoline, dried, and made up.

433 Moyer, J. W. 1932. Bird mounting from dried skins. Museum News, 10:6-8.

Outlines a method of relaxing dried skins which brings back some of the pliability of the fresh skin. The solution used was one quart sulphonated neatsfoot oil, one cup ammonia, and two quarts warm water. The solution is painted on the inside of the partially relaxed skin from the "damp box", allowed to remain for a day, and the skin scraped. A repeat of the latter may be necessary whereupon the skin is washed and mounted.

434 National Museums of Rhodesia. 1969. Degreasing of bird skins. Technical Bulletin no. 3.

Not seen. Citation from Inskeep, 1971 (No. 1217).

435 Olson, S. L., J. P. Angle, F. V. Grady, and H. F. James. 1987. A technique for salvaging anatomical material from study skins of rare or extinct birds. Auk, 104:510-512.

Outlines a method of removing the skull and long bones of the wings and legs of extinct birds. The study skin is relaxed in a moist chamber, the skull removed through cuts in the mandibular rami, and the entire skull and bill are cast for replacement in the skin. The long bones are replaced with wires.

436 Racey, K. 1938. Methods of preserving birds and mammals. Murrelet, 19:14-15.

Numerous suggestions appear in this paper. Fresh skins are degreased in gasoline. Old skins are relaxed by immersion in hot water for 12 to 24 hours, then scraped, washed in Ivory soap, bathed in gasoline, and made up. Also discusses a relaxing box and various chemical mixtures such as a modern day arsenic soap, and skull cleaning with a mixture of sodium sulphite, ammonia, soap, and water.

437 Septon, G. 1982. The Reunion. Lore (Milwaukee Public Museum), 32(4):2-11.

Popular easy reading article containing information on the preparation of a nest exhibit of Peregrine falcons. The adult specimen was relaxed from a study skin and the three young from approximately 60-year-old fluid specimens -- all four birds were collected together by H. L. Stoddard. Only some technical data are given, but the photography is excellent and each photograph tells a thousand words.

438 Septon, G. 1983. Swedish.

439 Soper, J. D. 1943. A method of remaking old birdskins. Auk, 60:284-286.

Discusses a method of quickly remaking older poor quality skins so that the specimens look better and are stronger. The old cuts are reopened, the interior swabbed or syringed with water, and the skins laid away overnight in a sweat box. The birds are then remade with a wooden support stick anchored in the beak.

440 Summers, P. 1979. Relaxing and cleaning old cabinet bird skins. Guild of Taxidermists no. 4:22-24.

Initially reviews many of the methods in previous use -- total immersion, injection of water, plaster box, zinc box, etc. A method was proposed where birds were placed on a plastic mesh basket over a layer of water in a closed container until relaxed. Detail is given on separating individual feathers within tracts, washing, and degreasing with solvent.

441 Sutton, G. M. 1916. Blood stains. Oologist, 33(3):60-61.

The author recommends cleaning bloody specimens by first washing thoroughly in luke warm water, plugging visible openings with cotton, and then applying and reapplying cornstarch to the areas and brushing off between applications with a toothbrush until fluffy.

442 Sutton, G. M., and W. Montagne. 1940. Washed birdskins. Wilson Bulletin, 52:91-95.

In attempting to characterize two local species of chickadee by color patterns, the author experimented with washing birds prior to preparation. Most birds in the study area in question were found to be dirty, leading him to routinely wash most skins in soapy water, followed by immersion in carbon tetrachloride and fluffing in plaster of Paris. Suggests caution be used in determining color based subspecies.

443 Turner, G. B. 1901. Cleaning the feathers of birds without absorbent. Osprey, 5(11 & 12):166.

The author, then chief taxidermist at the United States National Museum, experimented with washing bird skins in the same acid pickle currently used on mammal skins, followed by washing in soapine. The resulting pelts were clean, free from grease, and did not attract moths or dermestes as readily as unwashed specimens. He also suggests that "no absorbent of any kind should be used in drying feathers for it is next to impossible to get it all out again." Suggested use of the "electric fan" for drying.

444 Webster, F. S. 1884. How to clean soiled bird skins. Pp. 77-82, *in* Third Annual Report of the Society of American Taxidermists, 1882-1883, Gibson Brothers, Washington, DC. 126 pp.

One of the earliest papers describing routine cleaning of bird skins. The method described involves scraping, and absorbing fat with sawdust, cornmeal, or plaster of Paris. The bird is then swabbed with turpentine (or naphtha or benzene) and

fluffed in plaster. If not clean, the procedure is repeated. Dried blood is difficult to remove if set, but sugar water and glycerine had been tried.

445 **Windsor, A. S. 1938. Maintenance measures for the teaching museum. Turtox News, 16(2):40-41.**

Recommends cleaning mounted birds by first blowing away loose dirt, then covering the skin with dental grade plaster and saturating with carbon tetrachloride. This is worked into the feathers, allowed to evaporate, and the plaster blown out. Includes some suggestions for washing bones with soap flakes and repairing bones with Duco household cement.

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446 **Hankins, E. A. 1979. Principles of degreasing (fat removal) in freeze-dried specimens. Part I, 9 pp.; Part II, 11 pp.; Part III, 10 pp. World Museum of Natural History, Loma Linda University, Riverside, California.**

This three-part series, though geared for freeze drying, gives an immense amount of practical information about fat in general. Part I describes the basic locations and properties of fat with the last six pages devoted to in-depth discussions of fat in vertebrate groups. Part II gives a very good overview of the various solvents available for degreasing (4 pages) and then discusses aspects of degreasing including safety, recycling, and types (cold immersion, vapor degreasing). Part III describes a complete degreasing system with illustrations of cold immersion degreasing and vapor degreasing.

447 **Luchanski, M. G. 1981. Relaxation of mounted birds. Report of the Provincial Museum of Alberta, Edmonton, Alberta, Canada. 7 pp.**

This paper is an in-house report on a project involving relaxing taxidermy mounts and making them into study skins. Two methods were described. The soap bath method simply immersed the specimen in soapy water, and then fluffed it in potato flour and repositioned it in study skin form. The second method involved placing specimens over a citric acid solution in a humid box until relaxed. Includes numerous suggestions for repositioning various groups.

SEE ALSO

Huber, 1930 (No. 402).
Septon, 1987 (No. 814).
Sutton, 1962 (No. 406).

XI. LABELING SPECIMENS AND FIELD NOTES

This section contains general works on the recording of data on labels, exclusive of specific data covered in the following three divisions.

448 **Anderson, S. 1965. Sources of error in locality data. Systematic Zoology, 14:344-346.**

Attempts to point out some of the problems in locality data; for example, errors in the maps of an area or mistakes in not transcribing full data.

449 **Anonymous. n.d. Mammal localities. Trustees of National Museums and Monuments of Rhodesia, Causeway, Rhodesia. 2 pp.**

Describes a method for specifying localities by a quarter degree grid system using the letters A, B, C, and D for quarter degree squares within one degree of latitude and longitude; and the numbers 1, 2, 3, and 4 as designations inside these to make 1/16 divisions of each degree. Locality would be shown by a designation such as "*local name of area*" 20 28D4 for 20° south 28° east and the D quarter grid and no. 4 plot within that grid.

450 **Axtell, R. W. 1965. More on locality data and its presentation. Systematic Zoology, 14:64-66.**

Argues against four of the six methods outlined by Hutchinson, 1964 (No. 459), in that they base locality data on man-made structures. Axtell suggests latitude and longitude are more valuable for locality data because of their stability, and he provides details on available maps to use this system.

451 **Beardslee, C. S. 1958. The verifying account in ornithology. Kingbird, 7:109-112.**

Minor note suggesting that unusual or rare sight records should be very carefully authenticated and written up for publication. Printed originally in The Prothonotary, 23(5):25-27.

452 **Crawford, R. L. 1983. Grid systems for recording specimen collection localities in North America. Systematic Zoology, 32(4):389-402.**

Gives very detailed information on the use of the decimal geographic grid system using latitude/longitude (as opposed to minutes and seconds) to plot locality data with extreme accuracy.

453 **Dice, L. R. 1930. Methods of indicating relative abundance of birds. Auk, 47:22-24.**

Proposes a method of calculating the relative abundance of birds by keeping separate detailed lists by habitat area or time periods and computing the frequency each species appears on the accumulated lists.

454 **Emlen, J. T. 1956. A method for describing and comparing avian habitats. Ibis, 98:565-576.**

The classic paper on this topic. Outlines a complex but well-organized system of analyzing avian habitats. This system would be most valuable for those studying behavior or ecology but would also be helpful in annotating field notebooks for those on collecting trips.

455 **Emlen, J. T. 1958. The art of making field notes. Jack Pine Warbler, 36(4):178-181.**

Commentary on the need for researchers to begin making more field notes and to make accurate, succinct, and objective field observations on behavior.

456 **Hamilton, W. J., Jr. 1938. The desirability of recording full data on specimen labels. Journal of Mammalogy, 19:102.**

Suggests that collectors should attempt to record on the label as much information that can fit that may be of use in characterizing a specimen -- habitat, reproductive state, stomach contents, parasites, etc. This information, if put in a field catalogue, is not always available for use and important points would be better put on the label.

457 **Hawks, C. A., and S. L. Williams. 1986. Care of specimen labels in vertebrate research collections. Pp. 105-108, *in* Proceedings of the 1985 Workshop on Care and Maintenance of Natural History Collections (J. Waddington and D. M. Rudkin, eds.), Royal Ontario Museum Life Sciences Miscellaneous Publications. 121 pp.**

Historically reviews types of materials used for labels on natural history specimens, and gives possible problems that may arise from their use. Suggestions are given for choosing the proper quality of paper to be used for labels. Recommends and describes two methods of minor repair or conservation of paper labels. The first is reinforcing the label with Japanese tissue and wheat paste. The second is encapsulating the label in Mylar.

458 **Herman, S. G. 1986. The naturalist's field journal. A manual of instruction based on a system established by Joseph Grinnell. Buteo Books, Vermillion, South Dakota. 200 pp.**

Probably the most detailed text on keeping bird field notes ever written. The author had instruction in the Grinnell system over 30 years ago and has perfected and improved it with practice. All aspects of recording field observations are given including equipment; maintaining a field notebook, journal, species accounts, and catalogues; a primer for the types of material recorded; etc. Much of the text contains reprinted field-recorded data which give ample illustration in how to keep notes.

459 **Hutchinson, V. H. 1964. Distance and direction in locality data. Systematic Zoology, 13:156-157.**

Discusses four methods commonly used for describing localities. The first and rather undesirable method is to locate in reference to a fixed town or road miles from the site. The second, also a poor method, is to use airline distance and compass directions. The third method, that preferred by the author, is to locate by distance and compass points only (for example, 1 mile N, 2 miles W, Ridgway, Elk Co., Pennsylvania). The fourth method is the use of latitude and longitude.

460 **Lambiris, A. J. L. 1979. Recording of ecological data in herpetology. Journal of Herpetological Association of Africa, (21):11-18.**

Not seen. Citation from Simmons, 1987 (No. 1182).

461 **Purchase, D. 1973. The significance and limitations of field notes. Emu, 73:230-234.**

Points out a number of ways in which inaccurate or inadequate recording of data can render field notes useless for research. Does not actually discuss methods of recording field notes but would be useful reading to anyone making or using them.

462 **Remsen, J. V., Jr. 1977. On taking field notes. American Birds, 31(5):946-953.**

Popular article discussing the importance of field notes, how they should be recorded, and how to make use of them. Contains good data and ideas.

463 **Riemer, W. J. 1954. Formulation of locality data. Systematic Zoology, 3:138-140.**

Points out many of the flaws in current and past label locality data. Contains a list of ten bits of information that make a label useful.

464 **Rubio, M. V. 1968. On the contents and methods of recording field notes. Herp (Bulletin of the New York Herpetological Society), 4(5):13-18.**

Not seen. Citation from Simmons, 1987 (No. 1182).

465 **Smithers, R. H. N. 1973. Recording data on mammal specimens. Trustees of the National Museums and Monuments of Rhodesia, Causeway, Rhodesia. 11 pp.**

Excellent booklet on recording data for mammal specimens. Illustrates a standard form which includes most of the conceivable measurements and observations on specimens. Also illustrates typical mammal tags and shows a diagram for measuring mammals and describing reproductive structures.

466 **Ticehurst, C. B. 1925. Some points in labelling specimens. Ibis, 6 (11th Series):461-464.**

An early paper suggesting that conscientious collectors should include much more than the basic data on labels. Suggested information to record is molt, condition of sexual organs and related observations, and ossification of the skull.

467 **Van Tyne, J. 1952. Principles and practices in collecting and taxonomic work. Auk, 69:27-33.**

A catch-all paper containing bits of information on preparation and the proper way to write information on the label. Describes many of the problems commonly found on specimen labels.

468 **Wetmore, A. 1927. A method for keeping notes and files dealing with ornithology. Condor, 29:109-111.**

Describes a system of keeping field notes in which each species of bird has its own page. The advantage of this system is that when a researcher is examining data for one species, no flipping back and forth through the notebook would be required. Records are also maintained for laboratory work.

469 **Wheeler, G. C. 1965. Locality by legal description. Systematic Zoology, 14:66-68.**

The author favors the township range system of describing locality data, but mentions other mapping systems.

MANUSCRIPTS

470 **Kennedy, R. S. n.d. Filling out a label for bird skins. Cincinnati Museum of Natural History, Cincinnati, Ohio. 2 pp.**

Succinct description of the information that should be found on a museum label of a bird.

471 **Museum of Vertebrate Zoology. 1962. Specifications for museum labels for bird skins, small mammals, reptiles and amphibians. Museum of Vertebrate Zoology, University of California, Berkeley, California. 1 p.**

Uses labels with dimensions of 2-1/2 inches long by 9/16 inch wide of Byron-Weston linen record ledger paper. Includes details on printing and stringing.

472 **Remsen, J. V., Jr. 1985. Procedure for filling out LSUMZ bird labels. Louisiana State University Museum of Zoology, Baton Rouge, Louisiana. 4 pp.**

Excellent set of instructions for recording information on bird labels. The world would be a better place if every preparator followed these well written directions.

SEE ALSO

Parkes, 1963 (No. 032).

XII. TECHNIQUES FOR MEASURING BIRDS, RECORDING WEIGHT AND FAT, AND DETERMINING SEX

In addition to publications about the above techniques for recording specified data on birds, this section includes some papers describing the use of these data in basic ornithological research.

473 **Amadon, D. 1943. Bird weights as an aid in taxonomy. Wilson Bulletin, 55(3):164-177.**

Extensive paper presenting the argument that collectors should always record weight of birds prepared. Demonstrates that recorded weights may be valuable for systematics work.

474 **Baldwin, S. P., and S. C. Kendeigh. 1938. Variations in the weight of birds. Auk, 55:416-467.**

Pioneering paper on variations in bird weights. Analyzes nine years of banding data with 13,546 weights for 85 species, and plots daily and annual cycles of weight. Contains extensive discussion.

475 **Baldwin, S. P., H. C. Oberholser, and L. G. Worley. 1931. Measurements of birds. Science Publication of the Cleveland Museum, Natural History, Vol. 2. ix + 165 pp.**

The standard reference for measurement of birds. Gives extremely precise methods of recording every conceivable measurement. Amply illustrated. Includes a complete bibliography of earlier papers giving descriptions of the measurements taken by these workers.

476 **Banks, R. C. 1965. Weight change in frozen specimens. Journal of Mammalogy, 46(1):110.**

Suggests that the effects of weight change while a specimen is stored in a freezer are minimal. When specimens are collected and transferred via dry ice or other means for storage in a freezer, the weight may be recorded during preparation some months later with little change.

477 **Bergtold, W. H. 1925. The relative value of bird measurements. Condor, 27:59-61.**

Compares the four basic mensural characters of a bird skin -- lengths of wing, tail, tarsus, and bill -- and suggests that the wing measurement is more valuable than the other three.

478 **Blem, C. R. 1976. Patterns of lipid storage and utilization in birds. American Zoologist, 16:671-684.**

Excellent review paper on fat storage and fat cycling. Data contained within could be used to argue that collectors should always record not only the fat level but also the time of day collected.

479 **Boersma, P. D., and E. M. Davies. 1987. Sexing monomorphic birds by vent measurements. Auk, 104:779-783.**

Three species of live birds can usually be sexed by length and width measurements of the vent during or shortly after the egg-laying season. The time period during which these measurements are useful varies with the size of the egg the vent must accommodate.

480 **Caldwell, L. D., E. P. Odum, and S. G. Marshall. 1963. Comparison of fat levels in migrating birds killed at a central Michigan and a Florida Gulf Coast television tower. Wilson Bulletin, 75:428-434.**

The study shows some fascinating trends in amounts of fat at two towers in relation to migration and wintering grounds.

481 **Chardine, J. W. 1986. Mass or weight: What is measured and what should be reported? Auk, 103:832.**

Minor semantic argument suggesting that bird weights be reported as mass.

482 **Clark, G. A., Jr. 1979. Body weights of birds: a review. Condor, 81:193-202.**

Most recent review of the subject. Discusses the obtaining of weights and analyzing variation within species for daily, seasonal, migratory, yearly, sexual, and geographic patterns. Reviews some uses for weight data in areas such as systematics and ecology. Includes over 100 references.

483 **Clench, M. H., and R. C. Leberman. 1978. Weights of 151 species of Pennsylvania birds analyzed by month, ages and sex. Bulletin of the Carnegie Museum of Natural History, no. 5. 87 pp.**

Contains three pages of introduction with the remainder of publication devoted to raw data for each species broken into age, sex, and monthly samples. For each age/sex/month block, minimum, maximum, and standard deviations are given along with sample sizes.

484 **Connell, C. E., E. P. Odum, and H. Kale. 1960. Fat-free weight of birds. Auk, 77:1-9.**

Illustrates that the fat-free weight of birds is relatively constant for birds of the same size and species, and therefore the fluctuations in live weights are due almost entirely to fat content.

485 **Davis, D. E. 1947. Size of bursa of Fabricius compared with ossification of skull and maturity of gonads. Journal of Wildlife Management, 11(3):244-251.**

This report compares the size of the bursa, ossification of the skull, and the maturity of gonads in a collection of 700 Brazilian birds. The data show that the size of the bursa correlates well with skull and gonadal conditions, and would be a valuable measurement to use in conjunction with the other two in determining age classes, breeding seasons, etc.

486 **Erritzøe, J. 1983. Danish.**

487 **Erritzøe, J. 1985. German.**

488 **Haftorn, S. 1982. Variation in body measurements of the Willow Tit *Parus montanus*, together with a method for sexing live birds and data on the degree of shrinkage in size after skinning. Fauna Norv. Ser. C, Cinclus 5:16-26.**

Though primarily concerned with determining criteria for sexing live Willow Tits, the author was able to ascertain that a large percentage of museum specimens of this species may be sexed incorrectly and that linear measurements by the same measurer are not always reproducible. Wing measurements combined with weight data proved the most accurate.

489 **Hussell, D. J. T. 1969. Weight loss of birds during nocturnal migration. Auk, 86(1):75-83.**

Estimates of the weight loss via body metabolism were made by sampling two species of migrating birds through the night as they hit a lighthouse. Weight loss per hour was calculated for the Veery at 1.3% and for the Ovenbird at 1.0%.

490 **Jenni, L., and R. Winkler. 1989. The feather-length of small passerines: a measurement for wing-length in live birds and museum skins. Bird Study, 36:1-15.**

Because of the difficulty in obtaining reproducible wing length measurements (even with the same measurer) and the non-comparability of measurements taken from

live specimens with museum skins, the authors suggest using a single feather length as an indicator of size. Results are presented of comparison of measurements in 51 passerine species with the primary eight showing the most promise. The proposed method is illustrated.

491 **Larson, J. S., and R. D. Taber. 1980. Criteria of sex and age. Pp. 143-202, *in* Wildlife Management Techniques Manual. Fourth edition (S. D. Schemnitz, ed.), The Wildlife Society, Washington, DC. 686 pp.**

Discusses sexing and ageing for game mammals and birds. The information on birds includes criteria using bursa depth and size; feather characteristics (shape, wear, condition); plumage color; overall size; etc.

492 **McCabe, T. T. 1943. An aspect of collectors' technique. Auk, 60:550-558.**

A classic paper which is still the standard reference for description of fat levels in birds. Contains commentary on the need for recording data of the reproductive organs and amount of fat, and then devotes the remainder of the paper to this subject.

493 **Myers, E. C. 1928. Taking body weights of birds. Auk, 45:334-338.**

One of the first papers to stress that weight data may be of taxonomic value and should be recorded.

494 **Nice, M. M. 1938. The biological significance of body weights. Bird Banding, 9(1):1-11.**

The first review on body weights of birds. Despite the relative paucity of data, the author presents an adequate discussion of the ramifications of weight data on the study of birds.

495 **Reichenberger, E. M. B. 1923. Remarks on methods in measuring birds. Auk, 40:244-247.**

Discusses the differences between bird measurements in the United States and Europe and suggests compromises for uniformity. Ultimately the United States adopted the European wing rule and abandoned dividers. Currently much of the United States routinely uses wing chord while Europeans use the flat wing measurement.

XIII. RECORDING MOLT, PLUMAGES, AND COLOR

This section includes numerous systems of recording molt and describing plumage. It also includes papers describing color specifications relevant to plumage.

496 American Society for Testing and Materials. 1980. Standard method of specifying color by the Munsell System. ASTM Designation: D 1535-80, Philadelphia, Pennsylvania. 4 pp.

Basic description of the Munsell color system.

497 Ashmole, N. P. 1962. The Black Noddy *Anous tenuirostris* on Ascension Island. Part 1. General biology. Ibis, 103B:235-273.

An extremely detailed paper about molt with some innovative recording methods and analysis of data. Contains 45 references.

498 Ashmole, N. P., D. F. Dorwood, and B. Stonewood. 1961. Numbering primaries. Ibis, 103A:297-298.

Initially comments on the history of numbering primaries from both the outside to the carpal joint and vice versa. Proposes, with valid reasons, that all the world switch to one system of numbering beginning with the innermost primary as number one.

499 Clench, M. H. 1970. Variability in body pterylosis, with special reference to the genus *Passer*. Auk, 87:650-691.

Classic paper on the study of pterylosis by use of avian flat skins and X-ray techniques. Contains 55 references.

500 Cramp, S. (chief ed.), K. E. L. Simmons, I. J. Ferguson-Lees, R. Gilmore, P. A. D. Hollum, R. Hudson, E. M. Nicholson, M. A. Ogilvie, P. J. S. Olney, K. H. Voous, and J. Wattel. 1977. Handbook of the birds of Europe, the Middle East, and North America. Birds of the western Palearctic. Volume 1. Ostrich to ducks. Oxford University Press, Oxford, London, New York. 722 pp.

Pages 30-34 propose a system of nomenclature of molts and plumages based on that of Dwight, 1900 (No. 502), and is closest to that used in Europe (according to Ginn and Melville, 1983, No. 504).

501 Dutch Birding. 1985. Dutch.

502 Dwight, J., Jr. 1900. The sequence of plumages and moults of the passerine birds of New York. Annals of the New York Academy of Science, 13:73-360.

The first thorough description and naming of plumages and molts of birds. Many of the names presented in this paper are still used in Europe and much of North America.

503 Dyck, J. 1966. Determination of plumage colours, feather pigments and structures by means of reflection spectrophotometry. Dansk Ornithologisk Forenings Tiddsskrift, 60:49-76.

The paper describes the theory of objective measurement of color with a review of the literature on this subject. Gives an excellent description of various pigments and reflective colors found in feathers.

504 Ginn, H. B., and D. S. Melville. 1983. Moult in birds. British Trust for Ornithology Guide no. 19, BTO, Beech Grove, Tring, Hertfordshire, England. 112 pp.

A most excellent booklet which presents good summaries of plumage, molt and the annual cycle, the sequence and duration of molt, and recording methods. Forty-

nine pages are devoted to species molt accounts for British birds followed by a list of 719 references on the subject.

505 **Humphrey, P. S., and K. C. Parkes. 1959. An approach to the study of molts and plumages. Auk, 76:1-31.**

The classic American paper on this subject. Re-evaluates the then current terminology of plumages and molts, and suggests a new practical standardized terminology be used. This system is the most common one used in the United States but it is not the accepted one in Europe. See page 33 in the paper by Ginn and Melville, 1983 (No. 504).

506 **Humphrey, P. S., and K. C. Parkes. 1963. Comments on the study of plumage succession. Auk, 80:496-503.**

Well written response to Streseman's (1963, No. 517) criticism of the preceding paper (Humphrey and Parkes, 1959, No. 505). Continues to argue for adoption of the terminology put forth in 1959.

507 **Miller, R. S. 1958. The Munsell system of color notation. Journal of Mammalogy, 39:278-286.**

Compares the four commonly used systems for describing color and concludes that the Munsell system offers a higher standard of technical accuracy and the greatest adaptability to varied research problems. Proposes that the Munsell system replace the outdated and unreliable Ridgway color standards.

508 **Munsell Color. 1976. Munsell System of color notation. Munsell Book of Color - Glossy Finish Collection. McBeth Division of Kollmorgen Corporation, Baltimore, Maryland.**

This most up-to-date Munsell Book of Color displays approximately 1500 removable color standard chips for forty different hues. In two binders: 2.5R - 10G and 2.5 BG - 10 RP.

509 **Palmer, R. S. (ed.) 1962. Handbook of North American birds. Volume I. Yale University Press, New Haven, Connecticut; and London. 567 pp.**

General text on the birds of North America. The introduction reprints a double page color chart that originally appended an article entitled "A concise color standard" by R. S. Palmer and E. M. Reilly, Jr. (American Ornithological Union Handbook Fund, 1956) which discussed color specification. Also includes basic information on plumages, bird topography, and linear measurements.

510 **Ralph, C. L. 1969. The control of color in birds. American Zoologist, 9:521-530.**

A review article which first discusses the nature of bird colors and then relates their origins to genetic and physiological effects. Contains some interesting observations which can help the preparator understand this subject.

511 **Ridgway, R. 1886. Nomenclature of colors for naturalists and compendium of useful knowledge for ornithologists. Little, Brown and Company, Boston. 129 pp. and 17 plates.**

In the author's own words, this book contains "a nomenclature of colors (in seven languages) and a compendius dictionary of technical terms (58 pages) used in descriptive ornithology, together with a series of plates or diagrams illustrating the external anatomy of a bird in relation to the terms employed". This work was the first major concerted effort to bring standardized color and descriptive terms into systematic ornithology.

512 **Ridgway, R. 1912. Color standards and color nomenclature. Published by author, Washington, DC. 43 pp. and 53 color plates.**

This expanded version of the preceding work deals only with color -- definition, measurement, and theory. Consulting with many other sources, the author illustrates and names 115 colors. The colors are represented by small hand-painted areas (~1 x ½ in) arranged on plates with color intensity from pure white to lamp black. Since publication, many of these colors have not remained true.

513 **Selander, R. K., R. F. Johnston, and T. H. Hamilton. 1964. Colorimetric methods in ornithology. Condor, 66:491-495.**

Reports on the use of the Bausch and Lomb Spectronic 20 Colorimeter equipped with a color analyzer reflectance attachment. This setup provides spectral reflectance curves over a wide range of wavelengths which is useful in showing color change by geographic variation. Cursorially mentions the Macbeth Super Color Matching Skylight instrument for examining specimens under a standardized north sky daylight.

514 **Smithe, F. B. 1974. Naturalist's color guide supplement. American Museum of Natural History. 229 pp.**

This booklet was made to accompany part 1 of the field color guide published in 1975. In it, Smithe relates each of his proposed 86 color swatches to color descriptions in other color guides developed by Ridgway, Villalobos, and modifications of Hamly. The exact Munsell color is given for each swatch. Also correlates colors with actual bird color descriptions given by Ridgway in his The Birds of North and Middle America.

515 **Smithe, F. B. 1975 & 1981. Naturalist's color guide. American Museum of Natural History.**

Designed specifically for use by naturalists in the field and museum who want a small hand-held loose leaf booklet for color comparisons with birds. Part I had 86 color swatches. In 1981, an additional 96 color swatches were added to improve the scope of color.

516 **Smithe, F. B. 1981. Naturalist's color guide. Part III. American Museum of Natural History. 37 pp.**

Describes the 96 additional color swatches added in 1981 to the original naturalist's color guide.

517 **Stresemann, E. 1963. The nomenclature of plumages and molts. Auk, 80(1):1-8.**

This paper strongly advocates the continued use of the terminology proposed by Dwight, 1900 (No. 502), for the nomenclature of plumages and molts, and criticizes the system by Humphrey and Parkes (1959, No. 505). See also Humphrey and Parkes, 1963 (No. 506).

518 **Wood, D. L., and D. S. Wood. 1972. Numerical color specification for bird identification: iris color and age in fall migrants. Bird Banding, 43(3):182-190.**

Describes the ease with which the Munsell color system can be used to determine iris color for aging criteria in some birds. The abridged set of soil color charts worked well for the color range studied and can easily be carried in the field.

519 **Wood, D. L., and D. S. Wood. 1974. Numerical color specification for bird banders. EBBA News, 37:121-126.**

Expounds upon the system proposed by Wood and Wood, 1972 (No. 518) where an age class can be determined by comparison of eye color to known standards.

Of interest are three tables which document changes in iris color with age for 35 species of North American birds (some data are only tentative).

520 **Wood, D. S., and D. L. Wood. 1973. Quantitative iris color change with age in Downy woodpeckers. Bird Banding, 44(2):100-101.**

Reports on a study of the eye color of Downy woodpeckers which change iris color from immature to adult birds. By use of a single color chip the authors can examine live birds through much of the year and determine if they are immature or adult.

XIV. PNEUMATIZATION OF SKULL

Pneumatization of the skull has been used as a means of aging various groups of birds, primarily Passeriformes. Cited below are papers describing this method and the applicability of this technique.

521 Bremer, J. L. 1940. The pneumatization of the head of common fowl. Journal of Morphology, 67:143-157.

522 Chapin, J. P. 1949. Pneumatization of the skull in birds. Ibis, 91:691.

Short note suggesting that use of pneumatization be restricted to Passeriformes and that even within this group some species never do ossify fully.

523 De Haven, R. W., F. T. Crase, and M. R. Miller. 1974. Aging tricolored blackbirds by cranial ossification. Bird Banding, 45:156.

Reports on results obtained from recapturing and preparing 39 nestling banded birds of known age ranging from 15 weeks to 3 years. Ossification was generally completed by the 46th week, but one individual was not completely ossified even at 2 years of age.

524 Harrison, J. G. 1957. A review of skull pneumatization in birds. Bulletin of the British Ornithologists Club, 77:70-77.

A preliminary review of skull pneumatization summarizing some of the differences found in various groups of birds. Discusses how this skull modification may be purely adaptive and not an indication of phylogenetic evolution.

525 Harrison, J. G. 1960. A comparative study of the method of skull pneumatization of certain birds. Part One. Bulletin of the British Ornithologists Club, 80:167-172.

Compares the method of skull pneumatization for five species of Columbiformes and contrasts this with the system used in the Starling, House Sparrow, and eight species of Corvidae. The study confirmed that related species pneumatize very similarly but that unrelated species can have very different patterns. Completed in Part II.

526 Harrison, J. G. 1961. A comparative study of the method of skull pneumatization of certain birds. Part Two. Bulletin of the British Ornithologists Club, 81:12-17.

Part II of previous citation.

527 Hogg, D. A. 1980. A comparative evaluation of methods for identification of pneumatization in the avian skeleton. Ibis, 122(3):359-363.

Evaluated methods of determination of pneumatization using ink, latex, and radiology in comparison with visual observation through transillumination and found the latter method best.

528 Leberman, R. C. 1970. Pattern and timing of skull pneumatization in the ruby crowned kinglet. Bird Banding, 41(2):121-124.

Reports on a study of pneumatization in Kinglets by examination of skulls of living birds during banding operations. Found two distinct patterns of this process and hypothesizes that they may be representative of discrete Kinglet populations.

529 **McNeil, R., and J. Burton. 1972. Cranial pneumatization patterns and bursa of Fabricius in North American shorebirds. Wilson Bulletin, 84(3):329-339.**

Reports that in shorebirds, the bursa can be used as an age criterion in the fall, but the structure is completely eliminated within the first year of life and in some individuals in less than six months. Finds no correlation of age with pneumatization, but notes two different patterns separating the two shorebird families examined.

530 **Miller, A. H. 1946. A method of determining the age of live passerine birds. Bird Banding, 17:33-35.**

Discusses ageing birds by the degree of pneumatization. Describes a method by which live birds are examined for pneumatization by plucking part of the crown and cutting through the skin to the skull and sealing later with celloidin. (An unacceptable method because simply wetting the crown is sufficient for observation by today's methods.)

531 **Nero, R. W. 1951. Pattern and rate of cranial "ossification" in the House Sparrow. Wilson Bulletin, 63:84-88.**

One of the first papers with real data documenting the process of pneumatization of the skull. Banded hatchlings were collected at various intervals and examined. Ossification followed progressive symmetrical growth patterns but timing was variable.

532 **Schneider, K. J. 1981. Age determination by skull pneumatization in the Field Sparrow. Journal of Field Ornithology, 52:57-59.**

Reports on a study to calculate the rate of ossification in Field Sparrows. Ossification proceeds rapidly during the early stages (2%/day) and slower later on (1.2%/day), but complete pneumatization is not completed until mid-November.

533 **White, C. M. N. 1948. Skull ossification in certain Passeriformes. Ibis, 90:329.**

Notes that three species of African Passeriformes *Anthoscopus*, *Salpornis*, and *Vidua* never complete ossification of the skull.

534 **Winkler, R. 1979. German.**

XV. PREPARATION TECHNIQUES IN FOOD HABIT STUDIES

This section consists of a collection of papers describing the collection, preservation, and analysis of materials found in the alimentary tracts of birds and mammals. It also includes methods for studying food habits without sacrificing the birds.

535 **Anonymous. 1941. Directions for collecting materials for food habits studies. United States Department of the Interior, Fish and Wildlife Service Wildlife Leaflet 193. 8 pp.**

Basic instructions for collection of materials in the alimentary tract, pellets, droppings, and stomachs of vertebrates combined with information on record keeping.

536 **Drodz, A. 1975. Analysis of stomach contents of small mammals. Pp. 337-341, in Methods for Ecological Energetics (W. Grodzinski, R. Z. Klekowski, and A. Duncan, eds.), IBP Handbook 24, Oxford, Blackwell Scientific.**

Not seen. Citation from Nagorsen and Peterson, 1980 (No. 1146).

537 **Errington, P. L. 1932. Technique of raptor food habits study. Condor, 34:75-86.**

Discusses the various methods of obtaining information on food habits of raptors - field observation, nest studies, stomach examination, gullet examination, pellet examination, etc.

538 **Korschgen, L. J. 1980. Procedures for food-habits analyses. Pp. 113-127, *in* Wildlife Management Techniques Manual. Fourth edition (S. D. Schemnitz, ed.), The Wildlife Society, Washington, DC. 686 pp.**

One of the better sources for information on food habit studies, though it is written primarily for the wildlife technician. Gives information on history, purposes and types of study, sampling techniques, and materials and methods. Also has a great section on analytical procedures. Contains dozens of good references.

539 **Longland, W. S. 1985. Comments on preparing owl pellets by boiling in NaOH. Journal of Field Ornithology, 56:277.**

Suggests minor improvements on the Schuelar method of preparing owl pellets (F. W. Schuelar, 1972, A new method of preparing owl pellets: boiling in NaOH. Bird Banding, 43:142) using shorter periods of time and weaker solutions of sodium hydroxide. This improved method does not corrode aluminum bands that may be located in the owl pellets.

540 **Martin, A. C. 1949. Procedures in wildlife food studies. United States Department of the Interior, Fish and Wildlife Service, Wildlife Leaflet, 325:1-10.**

Not seen. Citation from Williams *et al.*, 1977 (No. 1158).

541 **Merriam, C. H. n.d. Instructions for the collection of stomachs. United States Department of Agriculture, Division of Economic Ornithology and Mammalogy, Circular no. 4. 1 p.**

One of the very early papers recommending that stomachs be preserved in 90% alcohol.

542 **Merriam, C. H. 1891. Directions for collecting the stomachs of birds. United States Department of Agriculture, Division of Ornithology and Mammalogy, Circular 12:1-3.**

Not seen. Citation from Thomas, 1977 (No. 1228). Presumably an expanded version of the preceding paper, but designed specifically for birds.

543 **Tomback, D. F. 1975. An emetic technique to investigate food preferences. Auk, 92(1):581-583.**

Reports on a method to collect food material which does not require sacrifice of the bird. A 1.5% solution of tartar emetic was forced into the stomach of five species of birds, and on the average, in ten minutes, the birds regurgitated the stomach contents, and showed no adverse reaction.

XVI. NECROPSY PROCEDURES

This short section includes papers describing autopsy procedures. The preparator should also consult Division XVII, Bird Parasites and Diseases, for related papers; and Division XXIII, Occupational Health Hazards to Preparators, for proper precautions while performing necropsies.

544 **Mann, P. 1983. Post mortem examination as a technique in avian research. Pp. 131-138, in The Effects of Oil on Birds: a Multidiscipline Symposium (D. Rosie and S. N. Barnes, eds.), Department of Pathobiology, University of Pennsylvania Veterinary School, Philadelphia, Pennsylvania.**

545 **Shilinger, J. E., and W. Rush. 1937. Post-mortem examinations of wild birds and mammals. United States Department of Agriculture, Miscellaneous Publication no. 270. 15 pp.**

Early paper detailing methods of gross dissection of specimens to ascertain cause of sick or dead animals. Also includes information on the most common causes of wildlife death and a small section on preservation of specimens.

546 **Sudia, W. D., R. D. Lord, and R. O. Hayes. 1970. Collection and processing of vertebrate specimens for arbovirus studies. United States Department of Health, Education and Welfare, Public Health Service. 65 pp.**

Not seen. Citation from Nagorsen and Peterson, 1980 (No. 1146).

547 **Van Riper, C., III, and S. G. Van Riper. 1980. A necropsy procedure for sampling diseases in wild birds. Condor, 82:85-98.**

Describes a basic necropsy procedure for wild passerine birds modified from the common techniques used for poultry or caged birds. Illustrates a typical necropsy protocol sheet and checklist. Contains a table on bird diseases caused by parasites, fungi, protozoans, bacteria, and viruses. Contains 28 references.

548 **Wobeser, G. A., and T. R. Spraker. 1980. Post-mortem examination. Pp. 89-98, *in* Wildlife Management Techniques Manual. Fourth edition (S. D. Schemnitz, ed.), The Wildlife Society, Washington, DC. 686 pp.**

Reasonably good paper containing general considerations and various bits of information about necropsy. The description of the physical techniques on birds (pages 91 to 94) is good and complements the paper by Van Riper and Van Riper, 1980 (No. 547).

SEE ALSO

Friend, 1987 (No. 555).
Brown and Stoddart, 1977 (No. 1127).

XVII. BIRD PARASITES AND DISEASES

This section includes publications describing collection of parasites from living birds and from birds recently sacrificed. A number of publications listed describe common diseases in birds or bibliographies on this subject. The preparator should consult Division XXIII, Occupational Health Hazards to Preparators, if handling diseased or heavily parasited birds.

549 **Arnall, L., and I. F. Keymer. 1975. Bird diseases. T. F. H. Publishing, Neptune City, New Jersey.**

550 **Beer, J. R., and E. F. Cook. 1957. A method for collecting ectoparasites from birds. Journal of Parasitology, 43:445.**

Describes a method for collecting all ectoparasites from a bird. The skin is sacrificed totally but this method could be used in skeleton preparation. Upon capture, the bird is sealed in a plastic bag with ether and later skinned on white paper and the loose ectoparasites collected. The skin is then held in a flask containing buffered trypsin and placed at 38°C for 12 to 24 hours, followed by the addition of potassium hydroxide which dissolves the remaining tissue. The mixture can then be rinsed, screened, and all the parasites counted and/or stained and mounted since they already were cleared.

551 **Cooper, J. E. 1986. Veterinary aspects of captive birds of prey. Second edition, with 1985 supplement. The Standfast Press, London. 288 pp.**

552 **Dalgleish, R. C. 1966. An improved technique for collecting bird ectoparasites. Turtox News, 44:75.**

Recommends that immediately after capture (or collection), a bird be dusted with silica aerogel powder (Dry-Die 67) and placed in a plastic bag which is in turn placed in a brown paper sack. After 15 minutes the bird is ruffled over a flat surface and then may be released or prepared. Parasites are preserved in 70% ethanol.

553 **Davis, J. W., R. C. Anderson, L. Karstad, and D. O. Trainer (eds.) 1971. Infectious and parasitic diseases of wild birds. Iowa State University Press, Ames, Iowa. 344 pp.**

Very comprehensive text on diseases in wild birds with contributions by 28 authors. Part 1 details viral diseases; part 2, bacterial, rickettsial, and mycotic diseases; part 3, parasitic infections; part 4, neoplastic diseases; and part 5, toxins.

554 **Fowler, J. A., and S. Cohen. 1983. A method for the quantitative collection of ectoparasites from birds. Ringing and Migration, 4(3):185-189.**

A modification of the "Fair Isle" apparatus for collecting samples of ectoparasites from live birds is given where birds are supported over collecting jars containing chloroform. Over 80% of the lice can be removed in 20 minutes, but a smaller number of mites are collected by this method.

555 **Friend, M. (ed.) 1987. Field guide to wildlife diseases. Volume I: general field procedures and diseases of migratory birds. United States Fish and Wildlife Service, Resource Publication no. 167. Washington, DC. 225 pp.**

Nicely illustrated guide to common diseases in wild birds. Three important sections are: chapter 1 which covers recording and submitting specimen history data; chapter 2 on specimen collection and preservation with a brief description of necropsy procedures; and chapter 3 on the shipment of specimens. Much of the remaining portion is devoted to a discussion of five bacterial diseases, three viral diseases, one fungal disease, three parasitic diseases, and lead and oil toxic poisoning.

556 **Halloran, P. O'C. 1955. Bibliography of references to diseases of wild mammals and birds. American Journal of Veterinary Research, 61(2):1-465.**

Not seen. Citation from Irvin and Cooper, 1972 (No. 672).

557 **Hilton, D. F. J. 1970. A technique for collecting ectoparasites from small birds and mammals. Canadian Journal of Zoology, 48:1445-1446.**

This author's technique for collecting ectoparasites is to place the entire animal in a glass container with sufficient 5% potassium hydroxide solution to cover it and leave it for 12-24 hours. The hair or feathers are then rubbed and the specimen removed (whence it may be examined for endoparasites or prepared as a skeleton). The solution is then heated for 1-2 hours at 95°C, left to stand for 12 hours, centrifuged, decanted, and again centrifuged in zinc sulfate after which the parasites are finally collected.

558 **International Council for Bird Preservation. 1988/89. Proceedings of Symposium on Disease and Management of Threatened Bird Populations ("Disease in Threatened Birds"). International Council for Bird Preservation XIX World Conference, Kingston, Canada, June, 1986. ICBP, Cambridge, England.**

559 **Kettle, P. R. n.d. A technique for collecting ectoparasites from live passerine birds. New Zealand Entomologist, 6(1):77-78.**

560 **Kocan, A. A., J. Snelling, and E. C. Greiner. 1977. Some infectious and parasitic diseases in Oklahoma raptors. Journal of Wildlife Diseases, 13:304-306.**

561 **McDiarmid, A. (ed.) 1969. Diseases in free-living wild animals. Zoological Society of London, Symposium 24, Academic Press, London. 332 pp.**

Not seen. Citation from Nagorsen and Peterson, 1980 (No. 1146).

562 **Mehl, R. 1970. Collection of insects and mites from birds and mammals. Fauna, 23:237-252.**

563 **Pritchard, M. H., and G. O. W. Kruse. 1982. The collection and preservation of animal parasites. University of Nebraska Press, Lincoln, Nebraska. 141 pp.**

564 **Richmond, N. D. 1951. Field methods for collecting mammal ectoparasites. Journal of Mammalogy, 32(1):123-125.**

Lists some methods of collecting ectoparasites in the field. Smaller mammals were placed in waxed bags with PDB for 20 minutes leaving ticks, fleas, and some lice in the bag. If more lice or mites were desired, the mammal was brushed over plain paper when removed from the bag. Mange mites were collected by soaking pieces of skin in water containing detergent.

565 **Watson, G. E., and A. B. Amerson, Jr. 1967. Instructions for collecting bird parasites. Smithsonian Institution, Museum of Natural History, Informational Leaflet no. 477. 12 pp.**

The classic paper on collection of bird parasites. Excellent information is given on collecting methods and preservation fluids. All parasite types are discussed: arthropods (louse flies, fleas, feather lice, ticks, feather mites, skin mites, nasal mites, etc.), Helminth endoparasites (trematodes, cestodes, nematodes, acanthocephala) and protozoans.

566 **Watson, G. E., J. S. Ash, and O. L. Wood. 1978. Ecological relationships between arboviruses, ectoparasites and vertebrates in Ethiopia. National Museum of Natural History, Smithsonian Institution Report Number 5 for Microbiology Program, Office of Naval Research, Arlington, Virginia. 156 pp.**

Presents the results of an eight-year study examining the vertebrate fauna of Ethiopia to identify reservoirs and vectors of arboviruses infecting man. Arboviruses are a group of agents transmitted by arthropods (mosquitoes, biting flies, ticks, etc.) from a natural reservoir to man and causing diseases such as yellow fever, dengue fever, etc. The majority of specimens tested were birds which present a greater threat because of the yearly migrations. A majority of the text (100 pages) summarizes the data obtained for each bird species.

567 **Williamson, K. 1954. The Fair Isle apparatus for collecting bird ectoparasites. British Birds, 47:234-235.**

Initial paper on the method of collecting bird parasites by suspending the bird into a jar or cylinder containing chloroform and allowing the bird to flutter. The head is kept out of the fumes through a hole in an oiled square of silk cloth.

568 **Wilson, F. H. 1928. Notes on the collection of Mallophaga. Canadian Entomologist, 60:27-28.**

Short paper advising preparators to examine the layer of cotton wrapped around a finished study skin when removing it. The author often found feather lice or other parasites clinging to this cotton wrapping.

XVIII. COLLECTION MANAGEMENT AND CONSERVATION

This section contains those works on management of bird collections including conservation of whole specimens. It also lists a number of papers dealing with other vertebrate groups but contain information relevant to bird collections. Two major works on collection management which should also be consulted are those by Williams, Laubach, and Genoways, 1977 (No. 1158); and Simmons, 1987 (No. 1182).

569 American Association of Museums. 1985. Collections management, maintenance, and conservation. American Association of Museums, Washington, DC. 144 pp.

570 American Museum of Natural History. n.d. A guide to policy, procedure, and conduct relating to the collection. Curatorial and supporting staff, Department of Ornithology, American Museum of Natural History. 85 pp.

Excellent booklet covering every aspect of the collection at the American Museum of Natural History. Succinct information is given for all topics and subtopics: description of the collections and catalogues, curating the collections, specimen labels and notebooks, loan procedures, accessioning, cataloguing, etc. Section XIII-1 gives a good description of field preparation of anatomical material.

571 Boettcher, F. L. J. 1912. Preservation of osseous and horny tissues. Proceedings of the United States National Museum no. 41(1897):697-705.

In order to prevent deterioration of bone material, various substances (shellac, varnish, and paraffin) were considered to impregnate or coat the bones. Paraffin was deemed the best material and instructions were given for its use in the field and laboratory on bone and ivory.

572 Cato, P. S. 1986. Guidelines for managing bird collections. Museology no. 7. 78 pp.

The most recent book in English for the day-to-day operation and management of a bird collection. Covers most aspects adequately but, due to space limitations, many subjects are only glossed over. A review by K. Garrett appeared in Collection Forum, 4(1):18-19, which was reprinted in Bird Collection Newsletter no. 1.

573 Clancey, P. A. 1952. Notes on the care and maintenance of study collections of birds and mammals. South African Museums Association Bulletin, 5(8):199-205.

Overview of general information on collection management of birds and mammals. Describes the purpose of study collections, methods of keeping a collection in good order (remaking greasy fat burned skins and cleaning oily feet), the use of metal cabinets with trays for storing specimens, suggestions for fumigation, labeling specimens, accessioning, cataloguing, and transportation of specimens.

574 Coleman, L. V. 1927. Manual for small museums. G. P. Putnam's Sons, New York. 395 pp.

Good early manual covering all aspects of running a museum. The text is divided into sections -- organization, administration, education, etc. Part three (pages 121-240) discusses curatorial work including accessioning, exhibits, collecting, preparation, etc. Most of the information is now out of date.

575 Grinnell, J. 1915. Methods of caring for study skins of birds. Proceedings of the American Association of Museums, 9:106-111.

Early paper on handling of bird skins. Gives recommendations about label information and attachment, storing specimens in cabinets and their management, and use of specimens for both scientific and educational purposes.

576 **Gütebier, T. 1986. Swedish.**

577 **Gütebier, T. 1987. Swedish.**

578 **Gyermek, S. A. 1964. Conservation of ethnological materials. Museum News Technical Supplement no. 4, Museum News, 43(2):49-56.**

General conservation article. Initially suggests that museums should maintain collections carefully, fumigating incoming material, and, in the case of conservation, either hire a specialist or experiment carefully before cleaning an object. Then offers suggestions on methods to conserve or clean leather, rawhide, hair, fur, feathers, bone, ivory, textiles, wood, basketry, metals, stone, and pottery.

579 **Hosford, J. 1987. Guidelines for environmental control within museum exhibition areas. South African Museums Association Bulletin, 17(5):200-204.**

Basic guidelines for a wide array of exhibition materials. Discusses the problems of light, heat, moisture, atmospheric pollution, and construction materials of exhibition cases, all of which may harm the objects on display. Recommendations are given for safe levels of light, heat, and moisture, as well as some methods to help control these levels.

580 **Howie, F. M. P. 1986. Conserving natural history collections: some present problems and strategies for the future. Pp. 1-6, *in* Proceedings of the 1985 Workshop on Care and Maintenance of Natural History Collections (J. Waddington and D. M. Rudkin, eds.), Royal Ontario Museum, Life Sciences Miscellaneous Publications. 121 pp.**

General overview of the status of natural history museums around the world with the English museums illustrating the problems common to all: insufficient funding, poor curation in some collections, inadequate storage facilities. Emphasis is placed on the need for research and development of better methods for preservation, preparation, and training of specialists in conservation and collection management.

581 **Lee, W. L., B. M. Bell, and J. F. Sutton. 1982. Guidelines for acquisition and management of biological specimens. Association of Systematics Collections, Lawrence, Kansas. 42 pp.**

Not seen. Summary of a study committee. Reportedly has an extensive bibliography on the preservation of invertebrates and vertebrates.

582 **Lewis, R. H. 1976. Manual for museums. National Park Service, United States Department of the Interior, Washington, DC. 412 pp.**

Reasonably good basic manual for operation of museums. Topics include accessioning, cataloguing, preparation, collection care, exhibits, etc. Contains little technical information. Replaces an earlier publication by the Park Service, 1941, written by Ned J. Burns and titled *Field manual for museums*, 426 pages.

583 **Lewis, S. D., and A. Redfield. 1970. Care of osteological collections. Museum of Anthropology, University of Missouri - Columbia, Museum Briefs 4. i + 1-18.**

584 **Long, C. J. 1970. Museum workers notebook. Privately published, 931 W. Elsmere Place, San Antonio, Texas. 183 pp.**

Small format, mimeographed book on many aspects of running a small museum.

585 **Majewski, L. 1973. On conservation, cleaning and care of ivory and bone objects. Museum News, 51(7):10-11.**

Written primarily for carved archaeological objects. Suggests bone and ivory be kept at a constant temperature (65-70°F) and relative humidity (45-60%) in order to reduce cracking and deterioration. Careful cleaning is accomplished by use of cotton swabs dipped in detergent solution or acetone. Polyvinyl acetate is the recommended glue.

586 **National Museums of Canada. 1983. Collections policy and procedures. Codex Musealis, 2:1-95.**

Not seen. Citation from Cato, 1986 (No. 572).

587 **Owen, D. 1964. Care of type specimens. Museums Journal, 63:288-291.**

Initially describes the types of types, and then how they may be used by researchers. Suggests that types only be located in well-cared-for collections, be properly labeled, and make reference on the label to the publication used to designate the specimen. Also gives loan recommendations.

588 **Rath, F. L., Jr., and M. R. O'Connell (eds.) 1977. Care and conservation of collections. American Association of State and Local History, Nashville, Tennessee. 107 pp.**

589 **Sharp, D. 1979. Conservation of natural history preparations. Guild of Taxidermists Newsletter no. 4:12-13.**

General article offering recommendations on how to prevent decay of specimens (i.e., conservation). An attempt should be made to reduce humidity and keep the temperature reasonable high. Offers some suggestions for fumigation and care.

590 **Steel, C. A. B. 1970. A system for the storage of mounted birds. Museums Journal, 70:10-12.**

During renovation of a natural history museum, approximately 2,000 bird mounts were taken off display and stored. The system used was to attach the birds to vertical panels inside tight cases containing a cross reference file on locality and species.

591 **Stolow, N. 1966. The action of environment on museum objects. Part II: light. Curator, 9:298-306.**

Excellent review article addressing the deterioration of museum objects by photochemical activity of light. Discusses various filters available and other activities which can reduce damage. Table one in the appendix gives a summary of probable damage from various light sources.

592 **Thompson, J. M. A. (chairman), D. A. Bassett, G. D. Davies, A. J. Duggan, G. D. Lewis, D. R. Prince (eds.) 1988. Manual of curatorship. A guide to museum practice. Butterworths, London. 553 pp.**

593 **Thomson, G. 1986. The museum environment. Butterworths, London.**

Not seen. Citation from bookseller's catalogue.

594 **United Nations Education, Scientific and Cultural Organization. 1968. The conservation of cultural property. United Nations Education, Scientific and Cultural Organization, Place de Fontenoy, Paris. 341 pp.**

A compendium of excellent articles concerning conservation of materials in museums. Contains information on almost every conceivable material with sections on molds and insect pests, conservation supplies, etc. A reasonable amount of the text is relevant to natural history specimens, collection management, and display.

595 **Van Cleave, H. J., and J. A. Ross. 1947. A method for reclaiming dried zoological specimens. Science, 105:318.**

Describes a process for using trisodium phosphate to restore certain kinds of dried zoological specimens, primarily invertebrates.

596 **Van Gelder, R. G. 1965. Another man's poison. Curator, 8(1):55-71.**

Basic information on management of a mammal collection. Topics include: transferring collections; care of skins, rugs, and mounts; fumigation, cleaning, and care of skeletons; caring for specimens in fluid; suggestions for field notebooks; and other miscellaneous collections.

597 **Wallace, E. 1978. The theory and practice of specimen documentation. South African Museums Association Bulletin, 13(1):26-36.**

Covers various aspects of collection management at the National Museum, Bulawayo (Zimbabwe). Describes the data storage and retrieval systems in the mammal and bird departments, and small sections on storage of specimens.

598 **Wythe, M. W. 1929. Some procedures in caring for a research collection of birds. Auk, 46:306-310.**

Recommends that bird skins be stored in white cardboard trays within the drawers. Presents suggestions for the organization of the collection and the incorporation of additional specimens.

599 **Wythe, M. W. 1938. Safe packing of dry study-skins of birds for shipment. Condor, 40:42-43.**

Reviews the current methods of packing skins -- packing in cotton; wrapping each skin in soft tissue paper; and using unprinted newspaper or magazine paper rolls for wrapping skins. The author suggests that the third method is best and provides additional information on it.

MANUSCRIPTS

600 **Dean, D. K., and W. Walker. 1975. Collection management of the Ornithology Division. The Museum, Texas Tech University, Lubbock, Texas. 107 pp.**

General reference for operation of the bird collection at Texas Tech. Includes information on acquisitions, data management (specimen information, labeling, field catalogues, etc.), laboratory preparation (skins, skeletons, and alcoholic specimens), collection management (arrangement, storage, maintenance, etc.), and an excellent bibliography.

601 **Denver Museum of Natural History. 1978. Collection policies and procedures. Denver Museum of Natural History, Denver, Colorado. 31 pp.**

Not seen. Citation from Cato, 1986 (No. 572).

SEE ALSO

Windsor, 1938 (No. 445).

XIX. FEATHER STRUCTURE AND CONSERVATION

This section includes major works on feather structure and smaller papers on feather conservation (i.e., care, cleaning, management, etc.) The reader is referred to divisions X (Washing, Degreasing, Relaxing, and Remaking of Skins), XVII (Collection Management and Conservation), and XXII (Post Mortem/ Preparation Changes in Color) for related articles.

602 Barton, G., and S. Weik. 1986. Ultrasonic cleaning of ethnographic featherwork in aqueous solutions. Studies in Conservation, 31:125-132.

Discusses the results of an interesting test to clean feathers with ultrasonic sound in conjunction with aqueous solutions. Six cleaning agents (detergents) were tested along with plain water on a variety of old feathers from ethnological material (50 to 100 years old) and mounted birds (at least 60 years old). After immersion for one through four and the extreme of thirty minutes, various feathers were evaluated with scanning electron microscopy. Despite obvious visible flaws seen in these pictures, the authors continued to recommend this method over hand cleaning. See also Young, 1988 (No. 612).

603 Chandler, A. C. 1916. A study of the structure of feathers with reference to their taxonomic significance. University of California Publications in Zoology, 13:243-446.

The classic work on feather structure. Established standard nomenclature of feathers and their parts. Also reviews the feather characteristics for the various systematic orders of birds with specifics on some suborders, families, genera, and species.

604 Davies, A. 1970. Micromorphology of feathers using the scanning electron microscope. Journal of the Forensic Science Society, 10:165-174.

Possibly the first use of a scanning electron microscope to view bird feathers in a systematic manner. Samples of down from the clothes of accused chicken thieves were identified as coming from galliformes and not duck feathers as argued by the defendants.

605 Gardner, J. S. 1982. Conservation: feathers -- as delicate and complicated as they are beautiful. Carnegie Magazine, 56(4):24-26.

Popular article on feathers outlining some of the problems that conservators face with cleaning and maintaining feathers in an ethnological collection. Presents no new material but summarizes the topic well for the layman.

606 Green, S. W., and P. S. Storch. 1988. An evaluation of feather cleaning techniques. Pp. 31-36, *in* Care and Preservation of Ethnological Materials, Symposium 86, Canadian Conservation Institute.

Short paper reporting on an attempt to evaluate various methods of cleaning feathers and observing the results by use of a scanning electron microscope. Unfortunately, the section on methods is poorly described, the photographs are at multiple magnifications, and the design of the study are too encompassing to make the paper of much value.

607 Lucas, A., and P. Stettenheim. 1972. Avian anatomy. Integument. Part I. Agricultural Handbook 362:1-340. United States Government Printing Office, Washington, DC.

An excellent text on all aspects of surface anatomy of birds. Part I includes a thorough discussion of topographic anatomy; pterylosis and ptilosis; molts and plumages; and the structure, shape, and texture of feathers.

608 **Lucas, A., and P. Stettenheim. 1972. Avian anatomy. Integument. Part II. Agricultural Handbook 362:341-750. United States Government Printing Office, Washington, DC.**

This second volume includes thorough discussions on growth of follicles and feathers, color of feathers and integument, feather and apterial muscles, microscopic structure of skin and derivatives, and an excellent chapter on techniques. Includes 24 pages of literature cited.

609 **Messinger, N. G. 1965. Methods used for identification of feather remains from Wetherill Mesa. Society for American Archaeology Memoirs, American Antiquity, 312(2), Part 2:206-215.**

Fascinating paper describing the identification of partial or whole feathers from archaeological artifacts (blankets, twine, ornaments, arrow parts, etc.) Species or orders were identified by characteristics of down and other feathers under magnification with a microscope. Part of the paper was a reprint of feather illustrations and nomenclature from Chandler, 1916 (No. 603).

610 **Voitkevich, A. A. 1966. The feathers and plumage of birds. Sidgwick & Jackson, London. 335 pp.**

A comprehensive monograph on the morphology, development, molting and neurohormonal regulation of the plumage of birds. Originally published in Russian under the title "Pero Ptitsy". Includes 50 pages of references.

611 **Wolf, S. J. 1978. Conservation: feathers. American Indian Art, 3(4):77-81.**

Popular article with a basic discussion of many of the problems conservators have with long-term storage and cleaning of feathers.

612 **Young, G. S. 1988. Disruption of feather structure by ultrasonic cleaning in aqueous detergent baths. Pp. 37-43, *in* Care and Preservation of Ethnological Materials, Symposium 86, Canadian Conservation Institute.**

A fascinating report on further experiments with the feathers used by Barton and Weik, 1986 (No. 602). Covert and flight feathers of six species of birds (coming from the same specimens used in the earlier study) were subjected to a more controlled but almost identical study by the Canadian Conservation Institute. In addition, a spectrophotometer was used to quantify the color changes. The illustrations given show some severe damage to certain species but none to others. Color did change in one structurally-based blue feather. Ultimately the author disadvised the use of ultrasonic cleaning. However, the uncertainty concerning age of the feathers (60 to 100 years old), unknown specimen history, and other factors such as ultrasonic frequencies, led him to suggest additional study.

MANUSCRIPTS

613 **Gowers, H. J. 1968. Featherwork and its conservation. Recent Advances in Conservation, United Kingdom Group of I.I.C. March, 1968. 4 pp.**

Reports on the cleaning and conservation of three feathered ethnological objects -- a feather head from Hawaii (circa 1790), a feather gorget from Tahiti, and a feather jacket from Japan (16th century). Various soaps and solvents were used for cleaning.

614 **Raphael, B. 1972. Feathers: notes on their properties, deterioration and conservation. Senior Research Project, Cooperstown Graduate Program in Conservation. 51 pp.**

A comprehensive study on the conservation of feathers. A tremendous amount of stimulating information is contained in this report intermixed with reviews of

earlier research and suggestions for further testing. Review topics include feather structure, keratin, natural oil on feathers, color, conservation methods (mechanical, wet and dry cleaning), consolidation, and mothproofing. Also, experiments were conducted to test the effects of various cleaning and chemical agents on feathers, photochemical degradation, and effects of heat. Many of the conclusions reached were preliminary because this was the initial in-depth paper to address this complex subject.

SEE ALSO

Knudsen, 1986 (No. 658).
Rogers and Daley, 1988 (No. 662).

XX. FUMIGATION, PRESERVATIVES AND MOTHPROOFING

This section deals with three related subjects, all aimed at preventing insect damage to specimens. Additional citations in Division XXIII, Occupational Health Hazards to Preparators, should be consulted when using chemicals for fumigation or impregnating specimens for insectproofing.

615 Anonymous. 1976. Fumigants ... procedures, precautions and institutional responsibility for their safe use. Association of Systematics Collections Newsletter, 4(1):5-6.

Discusses the use of fumigants, safety aspects, and federal regulations governing their use. Contains a table listing the estimates of odor thresholds for 21 fumigants and six mixtures, and maximum exposures believed safe for human subjects.

616 Anonymous. 1979. The dry preservative question. Van Dyke News, 1(2):1.

Defines a good taxidermy dry preservative as one which contains antimicrobials, and materials to retard insect damage, stabilizes moisture loss and will allow adhesion of the hide to the form. The article then more thoroughly describes these characteristics and lists the chemicals used in Van Dyke's dry preservative.

617 Anonymous. 1984. Museum infestation and fumigation. Guild of Taxidermists Newsletter no. 13:26-29.

Not seen. Citation from Stoate, 1987 (No. 632).

618 Edwards, S. R., B. M. Bell, and M. E. King. 1980. Pest control in museums: a status report. Association of Systematics Collections, New York. 34 pp + appendices A-G.

Reasonably recent bulletin on this subject; however, much of the information has been updated by Zycherman and Schrock, 1988 (No. 639).

619 Funk, F., and K. Sherfey. 1975. Uses of Edolan U in museum preparation and conservation of zoological material. Curator, 18:68-76.

Describes a test of Edolan U versus borax as a bugproofing agent by adding preserved material (in this case, a blackbird skin), each half treated with one agent, to a dermestid colony for three months. Also gives information on how to use Edolan for fresh animal skins, rugs, insect collections, and previously mounted specimens.

620 Kelly, P. 1981. Borax, good or bad. American Taxidermist, 15(4).

Not seen. Citation from Hangay and Dingley, 1985 (No. 067).

621 Kritzinger, C. C. 1945. Preservation of skins for museum purposes. South African Museums Association Bulletin, 3(12):351-352.

Describes the use of sodium fluosilicate, which can be used on hides and skins to prevent bacterial decay and insect damage. Suggests it may be used prior to curing with salt and may arrest partially decayed material.

622 Lee, J. 1984. Pesticides in museums. Biology Curators' Group Newsletter, 3:556-563.

Not seen. Citation in Horie and Murphy, 1988 (No. 069).

623 Lehmann, D. 1964. German.

624 Peltz, P., and M. Rossol. 1983. Safe pest control procedures for museum collections. Center for Occupational Hazards, New York. 8 pp.

Excellent paper that is the result of a condensation of information presented at a two-day conference in 1983 on safe pest control procedures for museum collections. Topics include pest control programs, effects of chemicals on artifacts, legal aspects, precautions for use, etc. Includes a valuable table giving pertinent information on nine commonly used fumigants.

625 Pray, L. L. 1951. A progressive moth-proofing technique for taxidermists. Museum News, 28(18):6.

Initial publication of the use of a borax solution containing formaldehyde to insect-proof specimens. (In actuality, the formaldehyde may be the only active ingredient.)

626 Pray, L. L. 1956. Borax mothproofing for modern taxidermy. Modern Taxidermist, Greenfield Center, New York. 32 pp.

Entertaining and humorous booklet on the history of borax mothproofing and the controversy that occurred among taxidermists in the first half of this century. Pray credits himself with inventing the use of borax which he claimed worked perfectly (even though borax was suggested as an additive to preservative mixtures prior to his involvement in taxidermy and has been shown to be ineffective).

627 Pringle, J. A. 1953. Control of mould and insect pests in museums. South African Museums Association Bulletin, 5(10):257-263.

The bulk of the paper is the result of a questionnaire sent to museums in South Africa surveying problems with mold and insect pests and inquiring after the methods used at that time. In addition, some general considerations and recommendations are given to reduce or eliminate these problems.

628 Rau, R. 1968. Insecticides and the Eulan treatment. South African Museums Association Bulletin, 9:60-63.

Short paper describing the various classes of insecticides. The three basic types listed are those that evaporate (naphthalene, camphor, hydrogen sulfide, etc.), the contact insecticides such as DDT, and the digestive insecticides as in arsenic. The author then reviews the then new use of Eulan U33 and Eulan B.L.S. which are not poisonous and render the specimens indigestible.

629 Redhead, D. 1968. Fumigation in the museum. Pp. 54-66, *in* Kalori - Proceedings of the Technical Seminar, South Australia Museum 17-20 September 1967.

The author first discusses the common museum insect pests: hide beetles, carpet beetles, clothes moths, silverfish, pests of wood, longicorns, ants, book lice, and bird lice. He then discusses methods of control and the common chemicals available for prevention of infestation and elimination.

630 Sharp, D. P. 1979. Preservatives in the taxidermist's workshop. Guild of Taxidermists no. 3:13-18.

The author initially presents a brief history of preservatives and goes on to discuss the desired qualities of a preservative and the causes of skin deterioration. He comments on his experiences with arsenic, phenol, burnt alum, and borax, and then describes the formulation of his recommended preservative soap containing bar soap, borax, camphor, turpentine, dettol, and whiting.

631 Stansfield, G. 1985. Pest control -- a collection management problem. Museums Journal, 85(2):97-99.

Discusses most of the types of fumigation and treatment of specimens with chemicals currently being used in Britain, together with new ideas for control of insect pests (microwaves, freezing). Concludes with noteworthy advice on this problem and a bibliography with over 20 citations.

632 Stoate, C. 1987. Beetles in store. Museums Journal, 86(4):196-197.

Discusses some of the findings of a study of museum beetle pests. A survey of the beetle population in the main store and loft (above the ceiling) over a number of months using Storgard traps showed high seasonability in numbers with a peak in spring. Apparently, one major avenue through which the insects enter the building is roof spaces, feeding initially on dead insects or bird nesting material (stray feathers, dead young, etc.)

633 Story, K. O. 1985. Approaches to pest management in museums. Conservation Analytical Laboratory, Smithsonian Institution, Washington, DC. 165 pp.

Surveys the common museum pests and reports on the various methods and materials used to control these pests. Contains an extensive section on this subject with over 400 citations.

634 Tenedini, K. 1986. Preparation baths and Edolan-U systems for conventional and freeze-dry taxidermy. Taxidermy Today, 8(2):63, 65, 67.

Basic description of the use of Edolan-U for preserving specimens, including formulas for the three-bath system.

635 Tenedini, K. 1988. Dermestids: a life test. Taxidermy Today, 10(2):78, 79, 81, 83.

Recent paper reporting test results of the mothproofing abilities of various recommended preservatives. Pieces of hair on deer hide were subjected to seven different processes (Edolan-U, liquid tanning, dry preservatives, borax, etc.), subjected to a dermestid colony, and then evaluated.

636 Tenedini, K. 1988. Edolan U as a mothproofing agent. American Taxidermist, 21(5):4-6.

Describes the use of Edolan U for insect-proofing a taxidermy or freeze dried mount. Since this publication, Edolan U has been removed from the market.

637 Williams, S. L., E. A. Walsh, and S. G. Weber. 1989. Developing chemical control strategies for museums. Curator, 32(1):34-69.

An excellent three-part article evaluating DDVP as a fumigant for museum collections. Part 1, "Effect of DDVP on a museum insect pest", uses the common pest *Dermestes maculatus* as a model, and evaluates the efficiency of fumigation on various life stages of the beetle. Part 2, "Behavior of DDVP in storage cases", reports on tests of various strategies of fumigation (concentration, placement in the case, air movement, temperature). Part 3, "Effect of DDVP on museum materials", details the effect DDVP has on various materials used in museum specimens, for storage of specimens, and the specimens themselves. Includes 59 citations.

638 Yadon, V. L. 1966. A portable fumigation chamber for the small museum. Museum News, 44:38-39.

Describes a small portable chamber that can be used to fumigate incoming material before adding it to the collection.

639 Zycherman, L. A., and J. R. Schrock. 1988. A guide to museum pest control. Association of Systematics Collections, Washington, DC.

XXI. POST MORTEM CHANGES IN SKIN MEASUREMENTS

The major theme of the papers listed below is the documentation of changes in basic body measurements between live or freshly collected specimens and dried prepared specimens. This correlation is necessary in studies utilizing museum specimens and relating measurements taken to those of live birds.

640 Bjordal, H. 1983. Effects of deep freezing, freeze drying and skinning on body dimensions of House Sparrows, *Passer domesticus*. Fauna norv. Ser. C., Cinclus 6:105-108.

A series of House Sparrows were measured to evaluate the effects of conventional freezing, freeze drying, and routine skin preparation drying compared to freshly killed specimens. Storage in a freezer increased bill, tarsus, tail, and wing length relative to fresh measurements, while both routine and freeze drying shrank all measurements except tail length which increased.

641 Bjordal, H. 1983. Bill measurements of House Sparrows *Passer domesticus* before and after skeletal preparation. Fauna norv., Ser. C, Cinclus 7:21-23.

Noted changes of 27% and 6% in bill length (from nares) and bill width before and after skeletal preparation. Much of the skeleton change was a result of the method of skeleton preparation using sodium carbonate and trypsin.

642 Davis, J. 1954. Seasonal changes in bill length of certain passerine birds. Condor, 56(3):142-149.

Though not related to post mortem change, the author of this paper notes a significant seasonal difference in bill length caused by differing food habits which should be considered when studying variation in populations or yearly fluctuations in this parameter.

643 Engelmoer, M., K. Roselaar, G. C. Boere, and E. Nieboer. 1983. Post-mortem changes in measurements of some waders. Ringing and Migration, 4(4):245-248.

Wing, bill, and tarsal measurements were made on 13 species of dried skins of Charadriformes and compared with measurements taken years earlier on the fresh bird. Only the wing measurement routinely showed a change with a decrease from 1.5 to 2.9%, the longer the wing the greater the percentage change.

644 Ewins, P. J. 1985. Variation of Black Guillemot wing lengths post-mortem and between measurers. Ringing and Migration, 6(2):115-117.

Fresh wings were measured by nine different experienced persons, and again at two months, 12 months, and 20 months. Variation among measurements was greater than repeat measurements by one person but not significantly so.

645 Fjeldså, J. 1980. Post-mortem changes in measurements of grebes. Bulletin of the British Ornithologists Club, 100(2):151-154.

Reports on a study of post-mortem measurements in seven species of grebes and suggests that great changes may occur in this group of birds. Wing and toe measurements decreased 3% while a full 4% decrease in bill length was found.

646 Green, G. H. 1980. Decrease in wing length of skins of Ringed Plover and Dunlin. Ringing and Migration, 3(1):27-28.

Observed a shortening of wing length measurements of Ringed Plovers (mean 2.7%) and Dunlins (2.2%) in the six months following preparation from the fresh skin. No further changes occurred after this period of time.

647 Greenwood, J. G. 1979. Post-mortem shrinkage of Dunlin *Calidris alpina* skins. Bulletin of British Ornithologists Club, 99:143-145.

Wing, tail, bill, and tarsal lengths were measured on freshly killed birds and after 18 months of storage as prepared study skins. There was a significant decrease in wing and tail measurements of 1.02% and 2.42% respectively.

648 Harris, M. P. 1980. Post-mortem shrinkage of wing and bill of puffins. Ringing and Migration, 3(2):60-61.

Observed a significant decrease in the length of the wing and bill during the first two months after death when fresh birds were compared to skins of the same birds. No further change was recorded at 19 and 48 months after death.

649 Knox, A. 1980. Post-mortem changes in wing-lengths and wing-formulae. Ringing and Migration, 3(1):29-31.

Noted a loss in wing length of approximately 1.24% after eight weeks time when compared to fresh birds. Also suggests possible changes in length and formula which can result from placement or differential shrinkage of the feathers in the skin.

650 Vepsäläinen, K. 1968. Winglength of Lapwing (*Vanellus vanellus*) before and after skinning, with remarks on measuring methods. Ornithologica Fennica, 45:124-126.

Estimated wing shrinkage of the Lapwing to be 2% in 11 skins.

XXII. POST MORTEM/PREPARATION CHANGES IN COLOR

Publications listed in this section include those concerning color changes in specimens as a result of preparation (washing, degreasing, preservatives used, etc.) and also papers noting changes of specimens over a period of time (foxing of plumage, effects of fluid storage, etc.).

651 Burns, W. J., Jr. 1952. Effects of preservatives on the fur color of mammal specimens. Unpublished Master's thesis, University of Idaho, Moscow, Idaho. iii + 35 pp.

This thesis represents a much more scientific investigation of the effects of preservatives on color than that prepared by Downing, 1945 (No. 654). A total of 22 mixtures and solutions were used and their effects tested on seven species of rodents, with changes measured by a photovolt photoelectric reflection meter. Recommendations are given for safe preservatives, embalming fluids, degreasing and cleaning agents, and relaxing fluid for mammal pelts.

652 Coetzee, C. G. 1985. The influence of preservatives on coat color of small mammals. Acta Zoologica Fennica, 170:67-68.

Tested various preservatives (arsenical soap, ethyl and isopropyl alcohols, sodium fluosilicate, magnesium carbonate, etc.), and suggested that many of the chemicals may be deleterious to mammalian color. Unfortunately the small sample size left the conclusions questionable.

653 Dickerman, R. W. 1963. The Song Sparrows of the Mexican Plateau. Minnesota Museum of Natural History, Occasional Paper no. 9. 79 pp.

Pages 31-34 serve to illustrate how color measurements can change seasonally by wear and fading. Often comparisons cannot be made with older series in collections due to foxing and other color changes. Geographic color variation should always be done on recently collected, evenly treated, fresh plumaged birds.

654 Downing, S. C. 1945. Color changes in mammal skins during preparation. Journal of Mammalogy, 26:128-132.

Addresses the subject of color change that occurs in the laboratory when a temporarily preserved skin is relaxed and made up as a museum skin. When comparisons are made, the color changes are noticeable on red squirrels, a number of other mammals, and some birds. Tests were conducted with solutions of arsenic, alum, borax, salt, and water, and the color changed in all samples of red squirrel pelage in as little as one hour's time.

655 Fry, C. H. 1985. The effect of alcohol immersion on the plumage colours of bee-eaters. Bulletin of the British Ornithologists Club, 105(2):78-79.

Minor note with major ramifications. Details the effect of short term alcohol immersion on feather color in one group of birds. The changes are so substantial that earlier workers without knowledge of this form of temporary preservation had described new subspecies based on the flawed specimens.

656 Gabrielson, I. N., and F. C. Lincoln. 1951. Post mortem color change in bird specimens. Condor, 53:298-299.

One of the earlier papers pointing out the changes that occur in skins with age, presumably due to foxing. This phenomenon makes comparison of new specimens with old specimens impossible. However comparisons of older birds with other

older birds and newer birds with similar aged specimens both separated out the races being investigated.

657 **Ghiselin, J. 1975. Post mortem change in a Black-crowned Night-Heron's eye color. Auk, 92(3):589.**

The eye color of a specimen of Black-crowned Night Heron changed from red-brown to red-orange in a 12-hour period when stored in a refrigerator. In most cases, color darkens after death and this illustrates an exception to the rule.

658 **Knudsen, L. R. 1986. Danish.**

659 **Stokoe, R. 1958. The spring plumage of the cormorant. British Birds, 51(5):165-179.**

Page 174 discusses the problems that occurred when two earlier workers divided two races of Cormorant by color and gloss. If new material had been used, color may not have been a valid criterion.

660 **Swenson, L. E. 1951. A field preservative for small mammals. Journal of the Colorado-Wyoming Academy of Sciences, 4:78.**

Short note describing temporary storage of material destined to be study skins in a mixture of equal amounts of turpentine and 95% ethyl alcohol. Some color change was noted.

661 **Wagstaffe, R., and K. Williamson. 1947. Cabinet colour-changes in bird skins and their bearing on racial segregation. British Birds, 40:322-325.**

Reports on comparisons made between freshly collected plumages and those of skins many years old. Differences are listed for over a dozen species to illustrate the changes in color which may occur. Suggests that much of the previous work of racial segregation based on color may be flawed.

MANUSCRIPTS

662 **Rogers, S. P., and K. Daley. 1988. The effect of preparation and preservation chemicals on plumage color and condition. 23 pp. The Carnegie Museum of Natural History, Pittsburgh, Pennsylvania.**

Report on a study investigating changes in 15 feather colors from 11 species of birds and simultaneous changes in structure of these feathers when subjected to various chemicals or mixtures in fluid condition for a time span of approximately two months. Color and physical changes were tied together with color changes weighted heavier. The resulting information on the 32 chemicals or solutions can be used to choose materials for washing, degreasing, spot cleaning, fluid preparations and buffers, and temporary preservation.

SEE ALSO

Dimpel, 1977 (No. 397).
French and Swenson, 1952 (No. 399).
Harrison, 1963 (No. 425).
Lloyd, 1918 (No. 431).

XXIII. OCCUPATIONAL HEALTH HAZARDS TO PREPARATORS

Included in this section are those publications addressing occupational hazards to personnel preparing or caring for specimens. Dangers would be transmission of diseases or parasites from specimens or contact with chemicals used in preparation or management of specimens (preservatives, solvents, glues, fumigants, etc.)

663 Anonymous. 1972. Chemical health hazards in taxidermy. Wide World of Taxidermy, 5(2):25-28.

Extremely well written and complete account of certain health hazards which relate to the taxidermist. The author discusses arsenic, borax, asbestos, methylene chloride, lacquer thinner, toluene, and lead, and lists some precautions the preparator should follow.

664 Center for Occupational Hazards. 1985. Reproductive hazards in the arts and crafts. Center for Occupational Hazards, New York. 3 pp.

Short article on the problems in reproduction that may be interrelated with exposures to chemicals commonly found in the workplace and home (paints, thinners, dusts, dyes, etc.) Summarizes dangers to males, females, fetuses, and newborns, as well as some ways to reduce risks.

665 Center for Occupational Hazards. 1985. Solvents in museum conservation labs. Center for Occupational Hazards, New York. 8 pp.

Excellent paper describing the various solvents often used by conservators (as well as preparators) together with the properties as they relate to safety -- ingredients, volatility, toxicity, health effects, fire hazards. Gives basic information of TLV, FP, VP, comments, organs affected, and symptoms for 50 commonly used solvents.

666 Cooper, J. E., D. J. Foxwell, R. Haile, R. Hendry, B. M. Logan, G. Y. McInnes, Dr. Nicholson, and F. R. Woodward. 1978. Taxidermists guide to practical hygiene in the working environment. Guild of Taxidermists Newsletter no. 1:10-15.

Consists of a set of guidelines for health and safety practices in the taxidermy workshop as they relate to the handling of fresh biological material. Gives recommendations to reduce infections, procedures for handling material, suggestions for the workroom, and for disposal of animal material.

667 Habicht, G. S., G. Beck, and J. L. Benach. 1987. Lyme disease. Scientific American, 257(1), July, 1987.

Excellent summary of lyme disease, describing a history of the disease, common symptoms, and possibilities of recovery. Portions reprinted in *American Taxidermist*, 21(3):15-19.

668 Hangay, G. 1983. Occupational health hazards to preparators. 1983 National Conference of Preparators and Technicians, Museum of Victoria, Melbourne, Australia.

Not seen. Citation from Hangay and Dingley, 1985 (No. 067).

669 Harben, E. F. 1968. The potential hazards of solvents, fumigants, repellents and the pesticides handled in the museum. Pp. 67-75, *in* Kalori - Proceedings of the Technical Seminar, South Australia Museum, 17-20 September 1967.

Initially describes the various modes of entry of chemicals -- aerosol, dust, fumes, mist, smoke, and vapor -- and some general precautions. The author then reviews in depth the chemicals commonly used in museums including fumigants

(formaldehyde, carbon disulfide), repellents (naphthalene, PDB), and insecticides/pesticides (chlorinated hydrocarbons, organic phosphates).

670 **Hawks, C. A., and S. L. Williams. 1986. Arsenic in natural history collections. Leather Conservation News, 2(2):1-4.**

Fascinating historical review of the use of arsenic in natural history collections. Includes directions for a simple and rapid wet chemical test to determine the presence of arsenic. Includes 44 citations in the bibliography.

671 **Hough, W. 1887. The preservation of museum specimens from insects and the effects of dampness. Report of the Smithsonian Institution for 1887:549-558.**

Though written primarily for the purpose of poisoning specimens to prevent their damage by insects, it now functions as a historical record of how specimens of that era may have been treated to warn workers of today to use caution in handling them. Various recommendations and formulas are given using arsenic, strychnine, mercuric chloride, etc.

672 **Irvin, A. D., and J. E. Cooper. 1972. Possible health hazards associated with the collection and handling of post-mortem zoological material. Mammalogy Review, 2:43-54.**

Excellent summary of the possible health hazards associated with wild mammals and birds. Basic information is given on cautions in handling specimens, methods of storage, and procedures to reduce danger of diseases. Pages 48-53 contain a checklist of 22 common diseases with summaries of species involved, symptoms in animals and man, sources and route of infections, and resistance.

673 **Jones, A. T. 1973. Museum health hazards. Kalori, no. 45:19-21.**

Discusses many of the chemical health hazards associated with museum workers. Defines much of the terminology used -- chronic vs. acute toxins, sensitizations, etc. -- and offers information for precautions when handling museum chemicals such as solvents, fumigants, dust, etc.

674 **Kannemeyer, S. X., and N. Schaefer. 1986. Safety in the museum laboratory and workshop. Part 1: toxic chemical hazards; Part 2: hazards associated with the handling and dissection of post-mortem animal carcasses; Appendix 2: table of chemicals including those commonly employed in South African museums; + Index. South African Museums Association Bulletin, 17(2):41-60, 74-89.**

Part 1 (14 pages) contains general knowledge on toxic chemical hazards. Includes a table listing carcinogens, teratogens and suspected mutagens. Thoroughly summarizes, in paragraph form, the problems with most of the chemicals that museum workers encounter and gives recommendations for reducing risks. Part 2 is short (3 pages) and is basically a list of safety cautions and standards. Appendix 2 lists in alphabetical order 150 chemicals (including many used in museums) together with the information on their dangers and common uses.

675 **Lassak, F. 1973. Dangerous museum chemicals. Kalori, no. 45:15-18.**

Short but excellent paper on this subject. The bulk of the paper consists of five tables listing materials used by museum employees and their hazards. Forty materials or groups are listed and include commonly used acids, bases, preservatives, solvents, and synthetic resins and materials.

676 McDiarmid, A. 1966. Safety precautions at post mortem examinations. Bulletin of the Mammalogy Society of the British Isles, 26:17-18.

Stresses that workers handling zoological material should use reasonable precautions to avoid communication of disease. Offers suggestions in collection of specimens, appropriate clothing, post mortem procedures, and first aid.

677 Morris, P. 1982. Stuffing for longevity. New Scientist, 95(1320):575.

Short article exploring in a historical manner the effect of the use of arsenic by taxidermists in 19th and 20th century Britain. A list of 32 taxidermists operating over this period had an average life span of 76 years, somewhat higher than the common man at that time. It appears then that if caution is used in handling this preservative, the practice is not life-threatening.

678 Muir, D., M. Lovell, and C. P. Peace. 1981. Health hazards in natural history museum work. Museums Journal, 80(4):205-206.

Summarizes investigations on various health hazards in the Bristol Museum and Art Gallery. Samples from various species of birds and mammals were analyzed for arsenic and mercury, with some specimens found to contain high levels of the former. Air samples were also taken to measure naphthalene, paradichlorobenzene, mercury, and arsenic, all of which were negligible.

679 National Institute for Occupational Safety and Health. 1981. Formaldehyde: evidence of carcinogenicity. United States Department of Health and Human Services, Public Health Service, Center for Disease Control, National Institute for Occupational Safety and Health. Current Intelligence Bulletin 34. 15 pp.

An excellent discussion on formaldehyde reporting it as the definitive cause of nasal cancer in laboratory rats and mice. NIOSH recommends that formaldehyde be handled as a potential occupational carcinogen. Includes 27 citations on formaldehyde and occupational/chemical hazards.

680 Perera, F., and C. Petito. 1982. Formaldehyde: a question of cancer policy? Science, 216:1285-1291.

Extensive article essentially discussing the politics of accessing carcinogenic evidence of toxic materials. Formaldehyde was shown to be carcinogenic in a number of studies on rats but at that point the EPA did not take a stance to limit its use, waiting instead for specific evidence. The authors suggest this is unequal treatment and editorialize profusely similar to lawyers arguing a case. An estimated seven billion pounds of formaldehyde is produced each year in the United States. Caution is suggested in its use. Contains an extensive bibliography.

681 Rau, R. 1980. Occupational health hazards for zoological preparators. South African Museums Association Bulletin, 14:13-16.

Short paper suggesting that the museum worker should treat all specimens as infected to prevent contraction of diseases possibly carried by these zoological specimens. Suggests precautions to take. Also reports on a new anti-rabies prophylaxis vaccine - HDCS.

682 Schweitzer, F. R. 1970. The toxicity of some museum chemicals. South African Museums Association Bulletin, 9(11):377-385.

Discusses in detail a number of chemicals (mostly solvents) which have been either banned, partially banned, or are of significant or suspected danger to the museum worker.

683 Sittig, M. (ed.) 1981. Handbook of toxic and hazardous chemicals and carcinogens. Publisher? [Second edition, 1985]. 950 pp.

Catalogues and describes over 300 toxic and hazardous chemicals, many of which are commonly used by the preparator and taxidermist, such as ammonia, arsenic, boric acid, dichlorvos, 1-1-1 trichloroethane, etc. For each chemical the information covered includes a description of the chemical, potential exposure, incompatibilities, exposure limits in air, harmful effects, first aid, disposal, etc., along with pertinent references on that chemical.

684 Waddington, J., and J. Fenn. 1986. Health and safety in natural history museums: an annotated reading list. Pp. 117-121, *in* Proceedings of the 1985 Workshop on Care and Maintenance of Natural History Collections, (J. Waddington and D. M. Ruskin, eds.), Royal Ontario Museum Life Sciences Miscellaneous Publications. 121 pp.

Very good short bibliography on health and safety with 76 recent titles on biocides, solvents, chemical hazards, ventilation, woodworking, plastics and adhesives, waste disposal, and general safety. Also includes institutional addresses for sources of information in North America.

685 Windsor, L. 1973. Safety aspects of solvent use. Kalori, no. 45:3-10.

Not seen. Citation from Hangay and Dingley, 1985 (No. 067).

686 Wood, W. 1884. How to use arsenic. Ornithologist and Oologist, 9(3):29.

Describes the methods of poisoning bird skins with pure powdered arsenic, and using mercuric chloride to paint the bill and feet. The author fumigated incoming skins by burning sulfur on hot coals placed in a closed box with the skins.

See Also

Peltz and Rossol, 1983 (No. 624).

XXIV. GENERAL TAXIDERMY

This division includes large texts and smaller papers on taxidermy which cover more than one vertebrate group (i.e., mammals, birds, reptiles, fish, etc.).

Within the annotations, reference is often made to publications intended for amateur or commercial taxidermists. No intention is made to denigrate the "commercial" taxidermist. Museum taxidermists prepare specimens that are intended to last indefinitely and are frequently viewed by millions of visitors. These mounts are often of uncommon species and the forms or mannikins must be built to unique specifications, a technique developed by Akeley and others, which takes an inordinate amount of time. Commercial taxidermists on average must have a sufficient volume of business in order to survive financially, and cannot spend the necessary time to individualize each mount. Their work is often done for indiscriminating sportsmen. Also, at least within the United States, commercial taxidermists are limited to game species. Taxidermy supply companies have made mannikins readily available and allow the commercial taxidermist to benefit from use of these forms. Museum taxidermists are often presented with seemingly impossible tasks (relaxing 90-year-old study skins or hides and creating mounts of extinct species) and deal routinely with specimens the commercial taxidermist never handles (such as warblers). Those publications listed below as tailored for commercial taxidermists include information designed to increase speed and improve quality generally on game species. However, they often include many tips that can improve museum taxidermy.

Special reference should be made to the work by Hangay and Dingley, 1985 (No. 067), which is the most recent complete text on general preparation and museum taxidermy.

687 Andersson, G. E. 1970. Swedish.

688 Anonymous. n.d. (circa late 1920s). Field guide: directions for preparing trophies and specimens for mounting. Jonas Brothers, New York. 32 pp.

Small pocket booklet with directions on preparation of specimens in the field for later mounting, and tips for care of mounted specimens in the home.

689 Barker, H. D. 1975. Some techniques used in the preparation of natural history specimens. Kalori no. 50:19-25.

Describes a number of procedures used to mount specimens at the Tasmanian Museum. Describes the building of a mannikin for a large mammal similar to that of Rowley, 1925 (No. 735) and covers various aspects of tanning, mounting, and finishing large mammals. A small amount of information is also given for bird mounting, embedding specimens in plastic, and a more lengthy description of reptile taxidermy.

690 Birontas, V. 1980. The most modern training manual in taxidermy history with conventional and freeze-dry methods. Published by author, Nisswa, Minnesota. 48 pp.

The author formed North Star Freeze Dry Co. in 1976, perhaps the most successful company in this market, and is considered by many to be a major contributor to research in freeze dry preservation. Twenty-two pages of text are devoted to conventional taxidermy with sections on birds, fish, small and large mammals, game heads and rugs. The freeze drying section is 16 pages and covers fish, bird, reptile, small mammal, and game head taxidermy with a section on fish painting. The text contains some innovative methods but can hardly be considered complete, and as far as being the most modern, I know of no professionals using razor blades to skin birds as is suggested.

691 Bornhalm, D. 1979. German.

692 **Bruchac, J. E., A. C. Berndt, and L. L. Pray. 1970. Professional taxidermy tips. Modern Taxidermist, Greenfield Center, New York. 116 pp.**

A large collection of tips on all phases of taxidermy and business management for the commercial taxidermist. Many are obvious or useless, but a few gems are included in this small book.

693 **Cappel, J. J. 1973. A guide to modelmaking and taxidermy. A. U. and A. W. Reed, Sydney.**

Not seen. Citation from Hangay and Dingley, 1985 (No. 067).

694 **Chauvin, B. 1985. Sculptor taxidermy methods. Modern Taxidermist, Greenfield Center, New York. 130 pp.**

A small format book about sculpting forms directly from polyurethane foam. The chapter on fish mounting is 43 pages; mammals, 31 pages; birds, 12 pages; snakes, 10 pages; with the remainder of the book full of tips on taxidermy. Written primarily for the amateur and commercial taxidermist.

695 **Cova, C. 1969. Italian.**

696 **Dahl, F. 1914. German.**

697 **Daigre, P. A. 1959. Practical taxidermy lessons for professionals and amateurs. Dan Chase Taxidermy and Supply Co., Inc., Baker, Louisiana.**

In three parts -- book one on bird mounting, book two on fish mounting, book three on sculpture and mounting mammals. Only book one was examined and it was reasonably good. The large format and concise descriptions allow for a lot of information to be dispersed. Gives instructions for mounting a starling, mallard, and ostrich.

698 **Davis, W. J. 1907. Bird and animal preserving and mounting. J. & W. Davis, Dartford. 206 pp.**

Complete text on taxidermy and natural history collecting. Includes numerous formulas for preservatives, instructions for collecting and preparing skins of birds, collecting eggs, taxidermy of all vertebrates, and collecting insects and shells.

699 **Didier, R., and A. Boudarel. 1921. French.**

700 **Echsel, H., and M. Racek. 1979. German.**

701 **Elwood, J. W. 1969. Lessons in taxidermy: a comprehensive treatise on collecting and preserving all subjects of natural history. Northwestern School of Taxidermy, Omaha, Nebraska. 160 pp.**

Gives basic information on all phases of taxidermy. Elwood started the first mail order taxidermy school in 1904 with the lessons based on the methods of Hornaday. The 1969 version examined had only slight improvements on the 1891 version of Hornaday. Through its history, over a quarter of a million people have had their initial foray into taxidermy through this school.

702 **Eykman, C. 1944. Dutch.**

703 **Farnham, A. B. 1916. Home taxidermy for pleasure and profit. A. R. Harding, Publisher, Columbus, Ohio. 246 pp.**

Includes only the basics of taxidermy. Of historic interest only. Second printing in 1944.

704 Ford, R. L. E. n.d. Collectors' guide. No. 2 - Elementary taxidermy. Watkins and Doncaster, Welling, Kent, England. 15 pp.

Small booklet describing taxidermy for the beginner. Topics include obtaining specimens, skinning (using a pigeon as a specimen), preparing cabinet specimens, and mounting birds and small animals.

705 Gardner, J., and C. H. Bisshop. circa 1900. Bird and animal stuffing. Dean's Practical Guide Series, London. 64 pp.

Not seen. Citation from Morris, 1986 (No. 1222).

706 Gestro, R. 1925. Italian.

707 Grantz, G. J. 1969. Home book of taxidermy and tanning. Stackpole Books, Harrisburg, Pennsylvania. 160 pp.

Popular book describing all phases of taxidermy and tanning. Many techniques are out of date. For amateurs only.

708 Grantz, G. J. 1973. Amateur taxidermy instruction manuals...bird mounting, 32 pp; animal mounting, 31 pp; game head mounting, 31 pp; amateur tanning, 36 pp; fish mounting, 48 pp; antler, horn, and foot mounting, 32 pp. Grantz Taxidermy, Allentown, Pennsylvania.

These are a series of small booklets covering various subjects on taxidermy. Each is very similar to corresponding chapters in the Grantz 1969 book (No. 707). For amateurs only.

709 Guerra, M. 1978. Italian.

710 Hasluck, P. N. 1901. Taxidermy comprising the skinning, stuffing and mounting of birds, mammals, and fish. Cassell and Company, Ltd., London. 160 pp.

One of the best early English books on taxidermy, written primarily for the sportsman hobbyist. Translated into French by L. Gruny in 1926.

711 Hawkins, K., and D. Deegan. 1974. K & D School of Taxidermy. The art of bird mounting; the art of full body mounting; the art of rug making; the art of fish mounting; the art of game head mounting. K & D Taxidermy Supply House, Winnipeg, Manitoba, Canada.

The only booklet examined was that on bird mounting which was ten pages in length. The description of methods is simplistic but covers the basics. A duplicate collection of booklets are published in French.

712 Herter, G. L., and M. E. Barrie. 1971. Herter's Professional Course in the Science of Modern Taxidermy. Fifth edition. Herter's, Inc., Waseca, Minnesota. 430 pp.

Contains very little information on taxidermy techniques, but an attempt was made to be up to date. The value of this book is in its hundreds of clear photographs of commercial and museum mounts and live specimens.

713 Hjortaa, H. 1975. Danish.

714 Hjortaa, H. 1978. Portuguese.

715 Holley, F. H. 1949. Manual for museum techniques. Bulletin of the Syracuse Museum of Natural Science no. 8.

Not seen. Citation from Henrikson, 1968 (No. 426).

716 **Jonas Brothers, Inc. Staff, (O. van Veen, ed.) 1984. The Jonas Technique. Volume V. Hints and Tips. Jonas Brothers, Inc., Denver, Colorado. 198 pp.**

Compilation of many tips and procedures not covered by previously written Jonas manuals. Topics include form alterations, base making, specific instructions on using pre-made head forms for mounting game heads, tanning, business management, and photography.

717 **Keeler, C. E. 1940. A simple method of mounting small exhibit specimens of mammals and birds. Science, 92:463-464.**

In this method, the specimen is initially injected with full-strength formalin to partially stiffen the body, which is posed, pinned into position, and stored overnight in formalin. The specimen is then skinned, the carcass molded, cast in plaster or wax, and reinserted into the detached skin which tends to retain the shape of the original pose.

718 **Kelly, T. 1987. Complete home taxidermy. Outdoor Life Books, New York. xi + 271 pp.**

Good basic book on methods used in commercial taxidermy. The author has published *American Taxidermist* magazine for a number of years and has a basic working knowledge of taxidermy which is adequately presented in this text. Valuable for even seasoned taxidermists who may find some information not available elsewhere, especially in sections contributed by some specialists; for example, Jack Wilson on birds. Nicely illustrated.

719 **Kempf, L., A. Kempf, L. J. Van Dyke, and C. Bohn. 1971. Taxidermy reference library. Game Head Mounting, 24 pp; Bird Mounting, 24 pp; Fish Mounting, 28 pp; Horn Mounting, 8 pp; Rug Making, 18 pp; Full Body Mounts, 31 pp; Tanning, 16 pp; Synthetic Taxidermy, 24 pp. Van Dyke Supply Company, Woonsocket, South Dakota.**

Originally written by the first three authors, but revised at a later date by Bohn who then became the fourth author. These books are for the amateur only.

720 **Labrie, J. 1972. The Amateur Taxidermist. Hart Publishing Co., Inc., New York. 156 pp.**

Poorly written book for amateurs. The basis of the book was the Elwood lessons on taxidermy (No. 701) which were imprecisely translated into French and then poorly translated back into English.

721 **Larsen, H. 1945. French.**

722 **Martin, T. R. 1978. Taxidermy Techniques. Indian Oaks Educational Media, Shabbona, Illinois. 62 pp.**

Small book covering all phases of taxidermy. Contains insufficient information on most topics.

723 **McCain, L. 1971. Brief directions for taxidermy procedures and animal preparation. Smithsonian Institution, United States National Museum, SIL 252:1-13.**

Consists of various tips suggested by the Smithsonian staff to improve methods of skinning, mounting, and coloring certain animals, and preparing skeletons and tanning skins. Includes a reference section and other miscellaneous information. Reprinted from a 1960 version.

724 **McFall, W. F. 1975. Taxidermy step by step. Winchester Press, New Century Publishers, Inc., Piscataway, New Jersey. x + 230 pp.**

Basic introductory book for the amateur. The author attempts to cover many of the techniques employed at major museums but inadequately or incorrectly describes many, and may actually confuse the situation more than help it.

725 **Metcalf, J. C. 1981. Taxidermy -- a complete manual. G. Duckworth and Company, Ltd., London. 166 pp.**

One of the two best recent English taxidermy texts. Contains a good section on bird taxidermy and scientific collecting. Appendix 2 has a checklist of diseases contagious to man and Appendix 3 is a checklist of sizes and colors of mammal and bird eyes. One of the few taxidermy texts to supply a reasonable bibliography of the works the author drew upon to write the text.

726 **Montes, L. M. 1980. Spanish.**

727 **Moyer, J. W. 1953. Practical taxidermy. A working guide. The Ronald Press Company, New York. 126 pp.**

A well written taxidermy book designed for the amateur but containing some information for the professional. Sold at least 40,000 copies with worldwide distribution. Based on an earlier work published around 1939.

728 **Moyer, J. W. 1979. Practical taxidermy. Second edition. John Wiley and Sons, Inc., New York. 146 pp.**

Updated edition including many of the improvements in the art form since the original came out in 1953. This book is better than most on the market but still lacks sufficient information to be very useful to the museum professional.

729 **O'Conner, P. A. 1983. Advanced taxidermy. Saiga Publishing Co., Ltd., 1 Royal Parade, Hindhead, Surrey, GU26 6TD, England. xi + 204 pp.**

One of the two best recent English taxidermy texts. Contains very good text and photographs on bird taxidermy, but the line photos are poor though they get the idea across. Contains a particularly good chapter on freeze drying and a list of eye sizes and colors for both European and North American birds and mammals.

730 **Pray, L. L. 1913. Taxidermy. Outing Publishing Co., New York, New York. Pages unknown.**

Initial text by this noted author. Covers aspects of bird taxidermy, small and large mammal taxidermy, etc. Replaced by the following text.

731 **Pray, L. L. 1943. Taxidermy. MacMillan Co., New York. viii + 91 pp.**

A classic work which probably sold more copies than any other taxidermy book in this century. By 1972 it was in its 26th edition. However, because of the small format and size, insufficient information is given to cover the subject thoroughly.

732 **Pray, L. L. 1975. The old taxidermist. Modern Taxidermist, Greenfield Center, New York, 188 pp.**

Entertaining book composed of short stories written by Pray for *Modern Taxidermist* magazine from 1939-1970. Contains little preparation information but packed with taxidermy humor in titles like "The Old Taxidermist Visit Hell."

733 **Reed, C. K., and C. A. Reed. 1908. Guide to taxidermy. Published by author. Second edition. Worcester, Massachusetts. 304 pp.**

First edition in 1903. General text on scientific preparation and taxidermy. The authors were widely known for their skill in bird taxidermy and a number of unique tips for that time are contained in the text.

734 **Roberts, N. H. 1979. The complete handbook of taxidermy. Tab Books, Blue Ridge Summit, Pennsylvania. 351 pp.**

Basic instructions in taxidermy for the amateur with sufficient information for the commercial taxidermist.

735 **Rowley, J. 1925. Taxidermy and museum exhibition. D. Appleton and Co., New York. xvi + 331 pp.**

Probably the best and most complete taxidermy and museum exhibition manual written in English between the text by Browne in 1896 (No. 979), and that by Hangay and Dingley in 1985 (No. 067). To be sure, many books were published in the interim, but they covered only specific subjects, not the whole field. Rowley made many improvements on his original book written in 1898 (No. 1082). He benefitted greatly from his work with Akeley and Clark and other notable legends in the field, and this book contains the first complete description of these new methods developed at the large museums in the United States, as well as some methods invented solely by Rowley.

736 **Runnels, S. R. 1971. Taxidermy. Dallas Natural Science Association Quarterly, 3(3 & 4):6-9.**

Not seen. Citation from Dean and Walker, 1975 (No. 600).

737 **Saslavsky, M. A. 1968. Russian.**

738 **Scheel, H. 1959. Danish.**

739 **Schröder, G. 1936. German.**

740 **Selmons, M. 1907. German.**

741 **Stehli, G. 1969. German.**

742 **Stoate, C. 1987. Taxidermy, the revival of a natural art. The Sportsman's Press, London. 168 pp.**

General taxidermy text. Citation from Stoate, 1987 (No. 632).

743 **Thorns, H.-J. 1981. German.**

744 **Tinsley, R. 1977. Taxidermy guide: the complete illustrated guide to home taxidermy. Second edition. Stoeger Publishing Co., South Hackensack, New Jersey. 223 pp.**

Poorly written book containing many outdated or inappropriate techniques. For the amateur only. Originally published in 1967 under the title "Shooter's Bible Taxidermy Guide", based on the professional techniques of Lem Rathbone.

745 **Tose, F. 1928. Trapping, tanning and taxidermy. Hunter Trader Trapper Co.**

Not seen. Frank Tose was the chief taxidermist at the California Academy in San Francisco and was known worldwide through the 1930-40s.

746 **Vernon, D. P. 1964. Some aspects of bird and mammal mounting. Pp. 69-73, *in* Kalori - Special Issue - Proceedings of Preparator's Conference, National Museum of Victoria, 10-13 November 1964.**

Contains many miscellaneous tips on various aspects of taxidermy. These include instructions on making bird mannikins of sisal fiber coated with celluloid, relaxing old skins in borax water overnight, creating mammal replacement skulls of granulated cork and polylight resin, reproducing ear cartilages of resin, chrome tanning instructions, etc.

747 **Walrod, D. 1983. More than a trophy. Stackpole Books, Harrisburg, Pennsylvania, 267 pp.**

748 **Ward, R. 1923. Rowland Ward's sportsman's handbook to collecting and preserving trophies and specimens. Eleventh edition. J. B. Burlace (ed.), Rowland Ward, Ltd., London. 75 pp. + 13 pp. advertisements + 16 pp. supplement.**

Originally printed in 1880. Essentially a companion for the sportsman giving basic information in all phases of taxidermy. According to Frost, 1987 (No. 1011), most of the information was taken directly from Edwin Ward, the older brother in the family business.

749 **Wood, N. R. 1980. Taxidermy for you. Sporting Book Specialist, Rhyl. 138 pp.**

Not seen. Citation from Morris, 1986 (No. 1222).

XXV. BIRD TAXIDERMY

Publications included in this section include major texts on bird taxidermy (Harrison, 1976, No. 782; Kish and Jonas, 1976, No. 789; and Schmidt, 1977, No. 809), and a large number of short papers on various aspects of bird taxidermy. Many of these papers have been published since 1983 and were not included in the bibliography section in Hangay and Dingley, 1985 (No. 067).

Since the major thrust of this annotated bibliography is bird preparation, many minor papers have been included in order to present as much information as possible. The senior author did not have access to complete library runs of *Taxidermy Review, American Taxidermist, (British) Guild of Taxidermists Newsletter,* and *Der Präparator*, so the user is referred to these journals for additional references.

750 Bäge, L. 1964. German.

751 Bales, D. 1983. Casting and painting turkey heads. Published by author, Picayune, Mississippi. 40 pp.

Not seen, description based on advertisement. Reviewed in Taxidermy Today, 6(1):57 (1984). "Contains 17 color and 24 black and white photos in this guide to preparation, molding, casting, curing, and finishing latex turkey heads."

752 Bales, D. 1984. Mount a strutting turkey? -- Sure you can! Taxidermy Today, 6(2):38, 39. 41, 43, 45, 47.

Fairly lengthy discussion on how to mount a strutting gobbler turkey. The article is reasonably well written and contains many author-discovered tips, but is too short to cover the topic adequately.

753 Billard, R. S. 1989. Memories of a great man: Dave Parsons, 1928-1985. Taxidermy Today, 11(1):36-39, 41.

The text is comprised mostly of a testimonial to Dave Parsons and the methods he used for mounting birds at the Yale Peabody Museum of Natural History. There are a number of materials and methods mentioned which allude to the standards to which birds were mounted by Parsons, who was one of the most talented bird preparators of this century.

754 Billard, R. S., and R. Morrill. 1986. Replica legs and feet. Breakthrough no. 12:23.

Gives detailed instruction for casting bird feet with rubber and then creating an identical polyester resin replica of the foot --with amazing detail.

755 Budin, O. A. 1976. Spanish.

756 Charnley, J. R. 1920. Hints on preserving and mounting birds. J. H. Wheldon and Co., London. 39 pp.

Small handbook designed as a guide for the amateur bird collector and taxidermist. Not illustrated.

757 Cochran, C. 1989. Wild turkey. A new mounting system. Breakthrough no. 20:26-29.

Short article detailing a method of mounting turkeys using a mannikin developed by the author. The method is designed to enable the preparator to mount turkeys rapidly and would work well for the commercial taxidermist.

758 Cowley, D. 1986. Avian arts: the power source. Taxidermy Today, 8(3):84-86.

Discusses two aspects of mounting waterfowl heads -- feather positioning and eye placement.

759 **Cowley, D. 1986. The master's touch: feather grooming. Taxidermy Today, 8(4):36-39.**

Details some observations on feather grooming to improve a taxidermy mount.

760 **Cowley, D. 1987. The master's touch: inside bird mounting. Taxidermy Today, 9(1):42, 43, 45, 47.**

Discusses the artificial body within the mounted bird, and how best to position the skin on that body.

761 **Cowley, D. 1987. The master's touch: to make a short story long ... a detailed procedure for setting eyes in bird mounts. Taxidermy Today, 9(2):42-53.**

Presents a method of setting eyes in taxidermy mounts based on measurements of the original skull with the eyes injected with water. Eyes are set to these specifications before the headskin is replaced.

762 **Cowley, D. 1987. The master's touch: The results justify the means. Taxidermy Today, 9(3):52, 53, 58, 59, 61, 63, 65.**

Discusses improvements in the head-to-neck area of a mounted bird by sculpting the back of the head and the first few vertebrae.

763 **Cowley, D. 1988. The master's touch: putting your best foot forward. Taxidermy Today, 10(1):52-59.**

Discusses the shrinkage of feet after mounting and suggests the usual solution to reduce this problem, which is to inject a solution of 50% formaldehyde and 50% glycerine.

764 **Cowley, D. 1988. The master's touch. Mechanical soundness: Too much is never enough. Taxidermy Today, 10(2):52, 53, 55, 58.**

Minor article suggesting use of heavier wire than customarily recommended for a particular bird and a wire staple to strengthen support.

765 **Cowley, D. 1988. The master's touch. Solid support: Too much is never enough (Part 2). Taxidermy Today, 10(3):42-45, 47.**

Suggests a method of supporting a wall-mounted bird by using Bondo to support a wire into the breast of the artificial body.

766 **Cowley, D. 1988. The master's touch. Put back everything you take out. Taxidermy Today, 10(4):92, 93, 96.**

Insightful article discussing how to replace the real body in a taxidermy mount with an artificial one whose the contours are correct, and includes all the tissue previously removed (i.e., also replace fat removed with the skin).

767 **Cowley, D. 1989. The master's touch. Reference: If you don't have it, you ain't got it! Taxidermy Today, 11(1):92-93, 96, 98, 100.**

Discusses the obvious -- a need for good reference material for creating a particular attitude or position of mount.

768 **Dahmes, S. 1988. The Breakthrough bird taxidermy manual. (B. Williamson, ed.), Breakthrough Publishing Co., Monroe, Georgia. 156 pp.**

The latest bird taxidermy manual published in America. Profusely illustrated with many photographs and diagrams. The text continually refers to items for sale by the publisher's supply house and steers the artist away from unique handmade items like wrapped bodies. Despite the large format, the liberal use of photos and

repetition of written material limits the amount of real information contained. Written for the commercial taxidermist who wants to become more commercialized.

769 **Davis, J., and W. Davis. 1915. Bird stuffing and mounting. Ninth edition. J. and W. Davis, Dartford and Kent. 60 pp.**

Not seen. Citation from Morris, 1986 (No. 1222).

770 **Dill, H. R. 1957. Mounting a bird. Museum Graphic, 9(3):11-14.**

Basic directions on mounting a bird after it has already been skinned. Though a short article, it contains most of the basics and sufficient unique tips to add to the education of most bird taxidermists.

771 **Dill, H. R. 1958. Heads and tail in taxidermy. Museum Graphic, 10(2):14-15.**

The author offers three methods to improve bird taxidermy. First, he describes in detail how to fill out a mounted bird with a clay-tow mixture and align the bill properly. Second, he gives directions on skinning out large heads without outside cuts. Third, he suggests that, in birds with large tails, the tail be removed, spread, and then reattached to the mount.

772 **Dill, H. R. 1965. The wine cork method for setting up birds. Museum Graphic, 17(1):17-19.**

Describes the ancient system of using a wire cork body and stuffing the bird with tow. The technique is applicable only for small birds and in the hands of a preparator skilled in this method.

773 **Ehrlich, T. 1977. Big bird -- little bird. American Taxidermist, 11(4):4-8.**

The author suggests that large birds can be mounted in the same manner as small birds, just on a larger scale. A straight cast was made from the skinned carcass and filled with polyurethane pour-in-place foam. The results obtained by this method are not of high caliber.

774 **Ehrlich, T. 1983. Jaw breaker. More than one way to skin a duck. Taxidermy Today, 5(3):47-48.**

Suggests that for skinning birds with heads too large to draw through the neck skin, the jaw be carefully broken, thus reducing the diameter of the head. For taxidermy, the head may be easily built up and the jaws realigned.

775 **Epping, O. M., and C. B. Epping. 1984. Eye size and eye color of North American birds. Privately printed. 37 pp.**

Excellent small booklet listing eye size and color for most of the birds inhabiting North America, designed for use by bird taxidermists in selecting artificial glass eyes. Includes eye data for immatures or females which vary in size or color from the adult male.

776 **Ferebee, J. 1987. Mounting waterfowl using artificial heads. American Taxidermist, 21(4):4-8, 12-14.**

Describes the use of artificial bills in taxidermy mounts of waterfowl. The author manufactures and sells a series of these and so insists that the quality of mounts is improved by their use.

777 **Garland, R. 1984. Bird basics/part 1. Taxidermy Today, 6(2):15, 17, 19.**

Simplistic instructions on the methods used in mounting a bird. Many of the techniques described are very old, and there are almost no innovative suggestions.

778 Garland, R. 1984. Bird basics/part 2. Taxidermy Today, 6(3):15, 17.

Describes a number of tips for finishing a bird mount --injecting feet, rebuilding eyes, painting bills and feet, etc.

779 Gouba, B. 1979. The turkey's head. American Taxidermist, 12(6):35-39.

The author suggests various ways of making the turkey head look more natural. The contours and lumps are modeled with Grumbacher paste and the snood is removed and remodeled. Also includes instructions for painting the head. Reprinted from the March-April 1975 issue of the same magazine.

780 Hall, J. 1988. Bird taxidermy; strutting wild turkey. Breakthrough no. 18:20-25.

Illustrates and describes the techniques of Ed Thompson for mounting a strutting wild turkey. The use of ultra-light filler to set the tail feathers is only one of the original tips contained in this article. The text is essentially an excerpt from Dahmes, 1988 (No. 768).

781 Hangay, G. 1977. Mounting a Galapagos turtle and a Cassowary. Kalori no. 52:46-50.

Describes the mounting of a large bird, in this case a Cassowary. The bird was skinned down the inside of each leg to the toes. The leg bones were kept in the mannikin -- the bulk built up of polystyrene foam. In the final mount, the head and legs were modeled in polyester resin containing tow or cotton. Also describes the mounting of a large turtle. Because of grease in the shell, the original shell was replaced with a cast of dyed fiberglass. The legs were attached separately to wooden blocks inside the shell. The head was modeled in Friesser's paste and freeze dried to keep the wrinkles.

782 Harrison, J. M. 1976. Bird taxidermy. Second edition. David and Charles, Newton, Abbott. xvii + 67 pp.

The best British book specifically on bird taxidermy. Covers all phases of scientific preparation, taxidermy, and collection management. Contains innumerable tidbits of information that can improve the taxidermy of the amateur and professional.

783 Hildreth, G. 1988. Tommy Knight; flying turkey mount. Breakthrough no. 17:62-65.

Describes the preparation of a flying turkey mount from initial skinning through washing and mounting using an artificial body.

784 Kelly, T. 1977. The dorsal incision. American Taxidermist, 11(4):27-38.

Describes the skinning and mounting of a sandhill crane by using a dorsal incision which allows for a more soundly put together mount.

785 Kelly, T. 1980. Balancing a bird. American Taxidermist, 13(5).

Not seen. Citation from Hangay and Dingley, 1985 (No. 067).

786 Kish, J. 1980. Turkey heads -- an experiment. Taxidermy Review, 8(4).

Part one of an experiment to produce a realistic turkey head by freeze drying only the skin which was placed over a sculpted head-neck mannikin but utilizing the original bill.

787 **Kish, J. 1980. Turkey heads -- an experiment (Part II). Taxidermy Review, 8(6):32-33.**

Presents the results of the test of freeze drying only the skin of the head of a turkey. Both heads used in the experiment had some flaws, but some recommendations are presented to improve the process.

788 **Kish, J. 1984. A potpourri of bird techniques. Taxidermy Today, 10(1):82-84.**

Describes a number of tips to improve mounting birds. Reprinted from Taxidermy Review, 13(2).

789 **Kish, J., and C. Jonas. 1976. The Jonas technique. Volume 1. Bird Mounting. Jonas Brothers, Inc., Denver, Colorado. 80 pp.**

Excellent American bird taxidermy manual. Thoroughly covers all aspects of taxidermy. Unique in that it adequately presents more than one way to accomplish a given task, and discusses the pros and cons of the various methods. Kish is one of America's most knowledgeable living taxidermists and Coleman Jonas was one of the American taxidermist pioneers of this century.

790 **LaPlante, D. P. 1978. A turkey for New York. Taxidermy Review, 6(5).**

Describes mounting a turkey for the New York State Museum. The head was reconstructed by casting the trapped feather follicles from a slipped plaster molt with layers of pigmented epoxy resin painted on. The body was reconstructed on 5/16" threaded rods and sculpted with sisal.

791 **Lundström, L. 1986. Swedish.**

792 **Marchetti, S. 1969. Italian.**

793 **Migdalski, E. C. 1942. New methods of preparing artificial feet and mandibles for birds in mounting. Museum News, 20(11):11-12.**

Reports on some innovations in making artificial accessories for birds. Migdalski and R. Morrill perfected a method of reproducing the feet of a large bird by electroplating with copper. The natural colors are recorded on a plaster cast for later duplication by airbrushed lacquers. Also describes a second procedure involved casting the feet and mandible (including the skull) in rubber.

794 **Moyer, J. W. 1933. New method of mounting birds. Museum News, 11:7-8.**

Describes a method of using the original cleaned skeleton of a bird to act as a framework for building up an accurately constructed mannikin to which the skin is then attached.

795 **Newmeyer, F. 1986. Using artificial bills and head. Breakthrough no. 13:20-22.**

Describes and illustrates the use of standard sized artificial bills in mounting. (Unfortunately all waterfowl of a given species are not uniform in size, so the technique functions only to save time -- not to improve the specimen.)

796 **Newmyer, F., and D. Luke. 1984. A better way to mount birds. Breakthrough no. 3:27, 29, 32.**

Discusses reference material, methods of observation, and construction techniques used in the creation of a wrapped excelsior artificial bird body.

797 **Newmyer, F., and D. Luke. 1985. A better way to mount birds. Part V. Taxiing the skin. Breakthrough no. 8:18-19.**

Useful tips on placement of feather groups, arrangement of plumage, and painting soft part colors for finishing a mounted bird. (Parts II through IV of this series could not be obtained from the senior author but were published in 1984-85 in *Breakthrough*.)

798 **Pereira, A. 1981. Casting the legs of a large bird. Taxidermy Review, 9(4):36-37.**

Illustrates and describes the procedure for creating a mold with latex and a support plaster jacket of a leg, and then casting in polyester resin to create an exact duplicate for a taxidermy mount.

799 **Piechocki, R. 1965. German.**

800 **Pirtzel, A. 1905. Danish.**

801 **Pray, L. L. 1956. The pheasant mounting book. Modern Taxidermist, Greenfield Center, New York. 32 pp.**

Small booklet on mounting pheasants. Because of Pray's writing style, it contains a good deal of useful information not found in books twice its size.

802 **Pray, L. L. 1986. The bird mounting book. Joseph Bruchac (ed.), Modern Taxidermist, Greenfield Center, New York. 68 pp.**

Excellent small booklet on mounting birds, containing all the basic essentials for standard taxidermy and some techniques not commonly found in other texts. Originally printed in 1965 without an additional eight pages on mounting a goshawk, which was reprinted from an issue of *Modern Taxidermist* magazine.

803 **Quentin, J. 1937. French.**

804 **Ragionieri, R. 1961. Italian.**

805 **Rockwell, R. H. 1917. Mounting game birds in natural poses. Old methods and secret devices have been thrown out and replaced by skilful [*sic*] mechanical ability, keen observation and artistic talent. Forest and Stream, volume unknown:604-605.**

Concise directions for mounting a bird with illustrations of the wrapped artificial body and wiring schemes.

806 **Roncagliolo, G. B. 1915. Italian.**

807 **Saslavsky, M. A. 1964. Russian.**

808 **Scheel, H. 1932. Danish.**

809 **Schmidt, R. H. 1977. How to mount birds. Second edition. Emporia State Press, Emporia, Kansas. 80 pp.**

Excellent American bird taxidermy manual. All aspects are thoroughly covered in this small booklet, which is a result of the author's contact with many of North America's finest bird preparators and taxidermists. Originally copyrighted in 1969, the first edition came out in 1972. The current edition is in its third printing.

810 **Septon, G. 1978. Reproductions on displaying grouse. Taxidermy Review, 7(2):58-63.**

A description is given on how to create the combs and air sacks (sometimes called boom sacs) in mounts of male New World grouse displaying these features. The

air sacs are modeled in clay, and cast in polyester resin. The combs were made by cutting, laminating, and painting pieces of paper and attaching them to the mount.

811 **Septon, G. 1979. Comb reproductions for domestic fowl. Taxidermy Review, 7(6).**

812 **Septon, G. 1981. Painting bills and feet. Taxidermy Review, 10(1):40-42.**

Discusses a method of improving the visual appearance of painted surfaces on mounted birds by creating an appearance of dimension with shaded areas and "forced light".

813 **Septon, G. 1982. Swedish.**

814 **Septon, G. 1987. German.**

815 **Serié, P. 1936. Spanish.**

816 **Sharp, D. 1979. Improving mounted bird heads. Guild of Taxidermists no. 4:32-33.**

Describes a method of sewing the tied ear socket skin of a bird back into the actual ear opening, thus preventing distention of this area in the finished mount.

817 **Sison, R. V. 1981. Simplified taxidermy. Zoological Papers no. 10. National Museum, Manila, Philippines. 16 pp.**

A simple portrayal of the methods used in the Philippines to mount birds. Includes some information not found elsewhere because the techniques must be adjusted somewhat to fit the environment in which they are performed (i.e., hot and humid tropical weather).

818 **Stoate, C. 1979. "Tips for tat" -- Improve your bird mounting. Guild of Taxidermists no. 4:37-38.**

Offers a concise description of bird mounting, so concise that it is of little use.

819 **Stoddard, H. L. 1922. Stuffed birds. Yearbook of the Pubic Museum of the City of Milwaukee, 2:182-184.**

Describes using carved and sanded bodies of balsa wood and cork for mounting birds, cork being preferred for bodies smaller than a robin. An illustration is given of balsa wood forms for a Snowy Owl and Cormorant.

820 **Tetley, A. R. 1982. Bird taxidermy. Tab Books, Blue Ridge Summit, Pennsylvania. 104 pp.**

Describes the basics of bird taxidermy using a duck for a model. Primarily for the amateur, but worth reading for the few tips contained within.

821 **Unges, E. E. 1980. Spanish.**

822 **Vandenbos, D. 1984. Innovation in bird mounting: the "Acra-Flex" technique. Curator, 27(4):287-297.**

Describes in excellent detail the preparation of a flexible latex bird body used to mount a bird. The bird is skinned in such a way that the tarsi are separated and only the digits and beak remain with the pelt. The head, neck, body, wings, and legs are cast, refined in clay, recast with a wire armature, and then used in the mount.

823 **Veasey, B., and S. P. Kurman. 1983. Bills and feet: an artisans' handbook. Published by authors. 64 pp.**

Not seen, description based on advertisement. Gives instructions for duplicating natural colors of feet and bills of waterfowl, game birds, and birds of prey. Includes

64 full color plates of 40 different waterfowl, ten birds of prey, and twelve species of game birds.

824 **Waters (Walters), L. L., and J. C. Moyer. 1933. Reproducing birds' feet in celluloid. Museum News, 10(17):6-7.**

Describes the casting of fresh posed feet of birds in plaster and then creating artificial feet in celluloid colored so that it appears translucent.

825 **Webster, F. S. 1882. On the placing and winding of bird feathers. Pp. 41-46, *in* Second Annual Report of the Society of American Taxidermists, 1881-1882, J. J. Withall, Rochester, New York. 58 pp.**

Describes a procedure of wrapping a finished mount to keep the feathers positioned properly while drying. Many of the suggestions could be used today to help position feather tracts in a lifelike manner.

826 **Wildlife Artist Supply Company. 1987. The Breakthrough waterfowl and bird finishing manual. Breakthrough Publishing Co., Monroe, Georgia. 192 pp.**

Not seen, description based on advertisement. Complete painting instruction for the bills, legs, and feet of 75 different birds, including all North American waterfowl, turkeys, and upland game birds. No color photographs.

827 **Williamson, B. 1986. How to properly skin a bird for a study skin or mounting. Breakthrough no. 11:26-27.**

Brief description of how to skin a bird for taxidermy. Many of the steps are not used in routine study skin preparation. See Rogers, 1986 (No. 134).

828 **Wilson, J. 1986. Bird mounting techniques. American Taxidermist, 20(4):14-22.**

Excellent short article describing the bird taxidermy procedures used by this famous Canadian taxidermist. Many of the specific techniques are unique because the author is in many ways self-taught. Includes some photographs of museum quality mounts.

XXVI. BIRD EXHIBITS - DESIGN AND HISTORY

This section is a collection of papers describing notable bird exhibits of the past and highlighting the history of these exhibits or the people who created them. Reference should also be made to Division XIV, General Taxidermy; Division XV, Bird Taxidermy; and Division XXXI, Historical Preparation.

829 Allen, J. A. 1909. The habitat groups of North American birds in the American Museum of Natural History. Auk, 26:165-175.

Describes the new hall of mounted birds placed entirely in habitat groups. The paper is similar in many respects to the larger publication by Chapman, 1909 (No. 836) includes some added information on details of this major accomplishment.

830 Amadon, D. 1958. The use of scientific study skins of birds. Curator, 1:77-80.

In part, because of the difficulty in finding competent taxidermists, a bird exhibit was created primarily by using prepared study skins. This allowed more plumages to be shown in the space allocated and was less expensive to create.

831 Amadon, D. 1964. A new Hall of North American Birds. Curator, 7(3):171-178.

Discusses some of the reasoning that went into the design of the "Frank M. Chapman Memorial Hall of North American Birds". For example, smaller birds were placed in smaller cases rather than large groups. Illustrations are given for some new cases and other refurbished cases from the original hall (Chapman, 1909, No. 836).

832 Barrett, S. A. 1924. The museum's group building program. Yearbook of the Public Museum of the City of Milwaukee, 4:110-121.

Describes eleven new lifesize groups at the Milwaukee Museum of which three are birds. One group is a nest scene of Double-crested Cormorants and associated species by H. L. Stoddard. The other two groups are birds in flight (seven Mergansers in the first and about 18 ducks alighting in the second). An interesting approach to exhibiting birds.

833 Bennett, R. 1909. A method of mounting birds' eggs. Museums Journal, 8:299-301.

Describes the method developed at the Ipswich Museum, England, for displaying a collection of eggs.

834 Cannell, P. F. 1988. Focus on exhibits: a museum program proposal. Curator, 31:5-8.

Because of the extremely rapid advances in scientific knowledge and the time required to create an exhibit which would be out of date by the time of its completion, the author suggests the use of printed handouts. Four examples of outdated label copy are discussed.

835 Chapman, F. M. 1904. Climatic variation in color and size of song sparrows. American Museum Journal, 4:18-19.

First exhibit to illustrate geographic variation in color and size of birds. Seven specimens of song sparrows from Alaska to Mexico and California to the Midwest were mounted geographically on a map of the United States.

836 **Chapman, F. M. 1909. The habitat groups of North American birds in the American Museum of Natural History. American Museum of Natural History Guide Leaflet, 28:1-48.**

Describes the first major hall in North America devoted entirely to habitat groups. Each group usually included the nest eggs and young along with the adult bird or birds plus an exact reproduction of the actual area surrounding the collection site. The entire exhibit took over ten years to complete. An illustration and discussion are given for each of the 21 groups. A shorter, popular article by Chapman describing this accomplishment with illustrations of nine groups appeared in 1909 in *Worlds Work*, 17:11367-11374.

837 **Cross, S., and A. Millward. 1983. The new bird gallery at the Manchester Museum. Museums Journal, 83(2/3):160-163.**

Discusses the entire procedure used at the Manchester Museum to renovate and upgrade the exhibit area devoted to birds. Describes the organizational process, educational themes, modification of cases, and lighting schemes, and evaluates the finished product.

838 **Cummings, C. E. 1922. A synopsis of the bird exhibit in the new museum. Hobbies (Buffalo Society of Natural Science), 2(10):3-17; continued in 2(11):3-17.**

Very involved discussion of the new bird exhibit at the Buffalo Museum of Science. This exhibit was perhaps the first to attempt to teach the viewer various subjects about birds: definitions of birds, skeleton anatomy and adaptations, feeding habits (seedeaters, birds of prey, etc.), life styles (wading, swimming), migration, coloration, etc. This theme approach was advanced for its time because many museums were still exhibiting T-perch synoptic series (and still are) or small family groups.

839 **Dettmann, W. 1962. Bird flight. Lore, 12(4):121-127.**

Describes an exhibit on bird flight at the Milwaukee Public Museum. Presumably this was one of the first exhibits to use an animated taxidermy mount. Earlier, a mounted Great Horned Owl was made to be able to flap its wings (Mechanical bird, 1952, Lore, 3(1):24-27) and "bird flight" was built around this case to explain the theories and mechanics of flying. An article in Museums Journal, 1961, 71(1):11-16 gives additional information on mechanisms for making animated natural history displays.

840 **Gardner, G. S. 1978. A new habitat group of Wood Storks. Curator, 21(2):101-110.**

Describes the steps taken in making a new habitat group at the American Museum of Natural History. Discusses collection of materials, duplication of plants, and creation of the diorama. Interesting reading for the layman on how habitat groups are made.

841 **Hanney, P. 1969. A new bird gallery at Birmingham. Museums Journal, 68(4):165-167.**

Describes a modification of the exhibit gallery in which 42 single species semi-habitat groups were condensed down and made to fit a scheme of eight dioramas. Illustrates new case design and discusses some of the methods used in refurbishing this exhibit.

842 **Hartman, S. G. 1972. New designs for a systematic exhibit of birds. Curator, 15(2):113-120.**

Describes a new approach to the display of a systematic series of Connecticut birds at the Peabody Museum of Natural History. Seasonal and age-related plumages are shown for each species. The placement, color schemes, and unique separation of

species and families tend to make this exhibit more satisfying than simple rows and rows of birds on T-perches.

843 **Hornaday, W. T. 1925. Masterpieces of American bird taxidermy. Scribner's Magazine, 78(3):261-273.**

Initially the author describes the beginnings of good bird taxidermy and habitat groups crediting Frederick Webster with the elevation in quality of this art form. Then, the author reviews the excellent bird groups in America discussing their creators. These include the habitat groups in the American Museum of Natural History by J. Richardson, Sr., Webster's condor/vulture group at the Carnegie Museum of Natural History, Homer Dill's cyclorama of Laysan Island in Iowa, etc. An earlier article by Hornaday had previewed large mammal taxidermy masterpieces - Scribner's Magazine, 1922, 72(1):3-17.

844 **Parr, A. E. 1959. The habitat group. Curator, 2(2):107-128.**

A rambling paper discussing the good and bad points of early habitat groups, semi-habitat groups, faunistic habitat groups, miniature dioramas, etc. Suggests that future exhibit production create vastly large open dioramas or improved design of dioramas to create the illusion of greater space than actually exists. Contains some excellent photographs of museum habitat groups from around the world.

845 **Parr, A. E. 1961. The revival of systematic exhibits. Curator, 4(2):117-137.**

Discusses a simple history of systematic style exhibits and suggests ways in which they can be made more aesthetic and functional. Amply illustrates examples of systematic exhibits found at museums in the United States and Europe and discusses their design and their strengths and weaknesses.

846 **Reger, H. S. 1922. An appreciation of William H. Werner. The Oologist, 39, Supplement no. 426. 22 pp.**

Details the life of W. H. Werner, an extremely talented taxidermist who practiced from the early 1860s through the early portion of this century. Werner could arguably be one of the first Americans to begin using birds in habitat groups, his earliest groups were about 1868-69. In later years, the habitat groups achieved were as good as or better than any in North America until completion of the habitat groups at the American Museum of Natural History. The habitat groups of William Werner (prepped 1865-1910) now reside in the Anniston Museum of Natural History, Anniston, Alabama. Over 600 specimens are extant in this collection, most of them birds. See Collection Forum, 1987, 3(1-2):28.

847 **Reynolds, V. J., and J. D. Macdonald. 1951. Recent developments in exhibiting birds. Museums Journal, 51:178-182.**

Discusses modifications in the bird exhibits at the British Museum and the reopening after having been closed by damage in the war. Illustrates and describes a new bird pavilion, some of its dioramas, and lighting and ventilation systems.

848 **Schultz, W. L. 1959. Milwaukee's new bird hall. Museum News, 38(2):24-27.**

Describes a new hall of birds designed to illustrate various topics on birds rather than from the classic systematic series. Topics include evolution, the study of feathers and molt, camouflage, birds and man, etc.

849 Stansfield, G. 1981*a*. The bird room at the Hancock Museum, Newcastle upon Tyne. Museums Journal, 80(4):199-201.

Describes in good detail the new exhibit at the Hancock Museum devoted to birds. According to the author, it is probably the most extensive bird exhibit in Britain. Departing from the systematic approach, it is composed of many cases with innovative themes designed to satisfy the viewer with information and beauty.

850 Stansfield, G. 1981*b*. Three new natural history galleries. Museums Journal, 81(2):81-84.

Initially discusses the revival of building exhibits using an ecological approach, thereby getting away from the rows and rows of systematically displayed specimens. The author then reports on three new galleries at museums which reflect this trend (Christchurch, Stoke-on-Trent, and Bristol).

851 Stansfield, G. 1983. Three new natural history exhibits -- Manchester, Liverpool and Kendal. Museums Journal, 83(2/3):164-167.

Describes the new bird gallery in the Manchester Museum, an evolution exhibit in the Merseyside County Museum, and an entirely new natural history gallery in Kendal.

852 Stoner, E. A. 1933. A collection showing food eaten by birds. Auk, 50:187-189.

Reports on a small exhibit case made from a collection of foods eaten by birds which were simply dried.

853 Tynan, A. M. 1981. A new bird room in the Hancock Museum. Museums Journal, 80(4):202-204.

Supplies some history about the formation of the new bird room in the Hancock Museum -- funding, planning, and implementation. See Stansfield, 1981*a* (No. 849), for details of the exhibit.

854 Webster, F. S. 1945. The birth of habitat bird groups. Annals of Carnegie Museum, 30:97-118.

Essentially a mini-autobiography of Frederick Webster documenting his many accomplishments in the field of taxidermy. Webster was an extremely prolific preparator who was credited with the preparation of the first habitat bird group in the United States in 1880. The idea of the habitat group was conceived much earlier when Webster used artificially created habitats to prepare stereoscopic pictures of mounted birds.

XXVII. SPECIAL TECHNIQUES IN TAXIDERMY

The papers listed below are those dealing with very specific techniques that were not categorized into any other major section on taxidermy. These techniques include hair or feather transference, restoration and refurbishing of mounts, creating reproductions, casting and sculpting, paper sculpture, etc.

855 Anonymous. 1959. Plastic latex. South African Museums Association Bulletin, 7:159.

Suggests that tears to the skin, loose wings, or broken necks in damaged bird study skins can be repaired with white plastic latex. This latex can also be used for closure of nuchal incisions in birds where this incision is needed to remove the skull.

856 Beck, H. T. 1941. The mounting of hairless and sparsely haired mammals. Museum News, 19(12):7-8.

Describes a method of mounting a mammal with little hair (in this case, a warthog) by hair transfer. After the skin was modeled and on the mannikin, the skin was cut in certain sections and tins placed in. A plaster and clay layer was first placed on, followed by a few layers of plaster. The skin was then soaked in a solution of lime water for a week or so until the hide was removed. The positive was built up to capture the hairs with celluloid and plastic wood.

857 Clarke, C. D. 1938. Molding and casting. Its technic and application for moulage workers, sculptors, artists, physicians, dentists, criminologists, craftsmen, pattern makers and architectural modelers. John D. Lucas Co., Baltimore, Maryland. 308 pp.

Although this text is over 50 years old, it is still the most complete on this subject. It contains dozens of methods on molding and casting, hundreds of formulas, and innumerable tips for improving the final product. Also includes information on creating reproductions in celluloid, artificial leaves, and molding body parts. The materials currently available for molding and casting are much different, but the technique has not changed. Second edition published in 1946.

858 Coffin-Grey, T. W., and K. M. Oake. 1969. Paper laminating in taxidermy. South African Museums Association Bulletin, 9:289-292.

Excellent article about making taxidermy manikins from paper. Originally suggested by Browne, 1896 (No. 979), and improved on by White in 1941 (see No. 879), this system uses heavy paper soaked in glue or paste to lay up layers within the mold of a sculpted form to make a body. Generally applicable to large bird and medium to large mammals only.

859 Cummings, C. E. 1944. Curlew restoration typifies a difficult museum problem. Hobbies, 24:100-103.

Much of the article is a discussion defending the value of experienced preparators and taxidermists to museums. Has a small section of text superficially discussing the relaxing and remounting of an old and poorly mounted bird. Illustrates the original mount and body as well as the superb newly constructed body and mount.

860 Davidson, R. R. 1956. A simple method of refurbishing faded mammal and bird mounts. South African Museums Association Bulletin, 6:122-123.

Reports on a method of recoloring specimens of birds and mammals where the original colors have faded. Fine quality oil paints are thinned with carbon tetrachloride and applied with a hand or air brush. By using good reference material, an otherwise useless mount can be made to look alive again.

861 Deaton, N. N. 1956. Sculpture -- taxidermy procedure for making manikins of haired animals and large birds. Smithsonian Institution Leaflet no. 73. 23 pp.

Outlines a technique of making mannikins for taxidermy which is slightly different from traditional methods. The plaster mold lines are unique and construction of the form within is composed of burlap and plaster.

862 Dill, H. R. 1951. Mounting an old rare bird of large size. Museum News, 28(16):7-8.

Discusses and illustrates the mounting of a whooping crane that was collected and embalmed nearly one hundred years earlier. The skull and lower legs were removed and attached to a manikin made of excelsior, papier mâché, and carved balsa wood. The skin was glued on in four pieces. Reprinted in 1956 in Museum Graphic, 8(4):13-14.

863 Dill, H. R. 1960. Casting the heads of birds such as vultures, turkeys, etc. Museum Graphic, 12(1):15.

Describes the feather replacement technique used to recreate life-like heads for taxidermy of birds having few feathers on the head. The technique involves mixing marble dust with plaster and then coating the head and making a mold which, upon decomposition of the head, contains the feathers. Colored wax is then placed in the mold and the plaster surface eaten/crumbled off with hydrochloric acid.

864 Dill, H. R. 1961. Making a replica of the Labrador Duck. Museum Graphic, 13(4):16-19.

Describes the creation of a "Labrador Duck" mount from portions of the skins of a Surf Scoter, a Goldeneye, and a White-Collar Duck. The head and bill were made from carved wood and the feet were from the Goldeneye. The finished product was not particularly well done, but the task was challenging.

865 Fremling, C. R., and D. L. Hemming. 1965. A new method of taxidermy using polyethylene glycol as an impregnation medium. American Biology Teacher, 27:697-701.

Presents a new method of preserving hairless and featherless vertebrate animals. The specimen is first injected with alcohol (isopropyl or ethyl) to fill out shrunken areas and hardened overnight in same. Then the specimen is injected and stored in polyethylene glycol 400 for a week until thoroughly impregnated, followed by replacement with polyethylene glycol 1540. The resultant specimen is much more solid than a conventional mount and is permanently stable from decomposition.

866 Fuehrer, O. F. (von). 1938. Liquid rubber, a new casting medium. Museum News, 15(16):7.

Perhaps the introductory article on the use of liquid rubber for taxidermy purposes. Reports it can be used for diorama work (reproducing trees, rocks, etc.), and for casting living objects (reptiles, amphibians, and fish).

867 Gütebier, T. 1980. German.

868 Gütebier, T. 1987. German.

869 Hangay, G. 1980. Squeeze-casting of carcasses. An aid for the sculpto-taxidermist. Pp. 28-30, *in* 1980 Conference of Museum Preparators, The Australian Museum, Sydney. 160 pp.

Basic description of the Inchmuk method of large mammal mannikin formation. A carefully skinned carcass is laid out as close as possible to the desired position. Then the muscles are marked with indelible pencil and the body molded in plaster. Once dry, the mold inside is covered with cellophane, remarked with pencil, and plasticine is laid in (a plaster core is required on the largest mammals). When the

plaster shell is removed, the clay model needs only minor sculpting to imitate the animal in life.

870 **Head, W. 1972. Polyurethane and taxidermy. Kalori no. 43:38-41.**

This article was one of the first in Australia describing the use of polyurethane in taxidermy. The author describes sculpting the body form of a large mammal and making a cast (the "Akeley" method) and then fills the cast with polyurethane foam. Good detail is given on the latter task. Also suggests that bird and small mammal bodies can be directly carved out of foam.

871 **Hicks, D. 1966. Reproduction of biological specimens in neoprene latex. Museum News Technical Supplement, 15:45-50.**

Describes the casting of fish, amphibians, and reptiles in plaster of Paris and recreating the living form in latex. The reproduction is then painted with automotive lacquers. Other suggested applications of this technique are casting turkey heads, small mammal manikins, and botanical specimens.

872 **Laybourne, E. G. 1934. Recent uses of the Walters method in taxidermy. Museum News, 11(16):6-7.**

Reports on some of the improvements made in the Walters method of hair transference taxidermy since his publication (Walters, 1925, No. 878).

873 **Lossin, R. 1964. Large animal taxidermy. Pp. 47-50, *in* Kalori - Special Issue - Proceedings of the Preparators' Conference, National Museum of Victoria, 10-13 November 1964.**

Describes a very involved procedure when the head skin of a large mammal is impregnated with paraffin. First, a face mask is made and while the head skin is soaking in alcohol for 48 hours, the cast head is modeled. The skin is then placed on this model and impregnated with paraffin by spraying or soaking. The modeled face mask is replaced inside the waxed head and the entire object placed through a series of alcohol into xylol and finished with paraffin (as in histology). The surface paraffin is then removed with benzene or chloroform.

874 **Pretorius, P. J. 1972. An improved method in taxidermy. South African Museums Association Bulletin, 10:114-119.**

Describes a method developed at the South African Museum, Cape Town, which the author called fur transplanting. The procedure involves trapping the hairs of the hands and feet of primates in an unvulcanized rubber latex. The appendage is then macerated and removed, whereupon the foot is recreated with dyed resin and added to the remaining conventionally mounted specimen. The results are impressive.

875 **Rau, R. 1968. Dermo-sculpture without the skin. South African Museums Association Bulletin, 9(5):164-167.**

Reports on some initial experiments on hair transfer from the original skin to a replacement material. Three materials were used for embedding the hair -- plaster of Paris, paraffin wax, and natural rubber latex. Describes experiments on a jaguar skin, a domestic cat, squirrels, and a guinea pig.

876 **Renshaw, G. 1921. Models of the Dodo. Museum Work, 4(2):63-64.**

Popular article discussing a bit of the history and techniques of making artificial reproductions of extinct birds. The Dodo was the first to be restored in 1848. Contains an illustration of a plaster Dodo in the Museum of the Jardin des Plantes at Paris.

877 Sheridan, P. 1978. Formax preserved birds. American Biology Teacher, 40(1):21-22, 35.

Describes the preservation of birds by injecting them thoroughly with Formax -- a solution of full-strength formaldehyde saturated with borax. Gross details are given for injecting and spreading the birds to produce mounted specimens from birds the size of passerines to that of Mute Swans by this mummification process.

878 Walters, L. 1925. New uses of celluloid and similar material in taxidermy. Field Museum of Natural History, Museum Technical Series no. 2, Chicago. 20 pp.

A mostly theoretical paper which appears to be written more for the philosopher than the practitioner. Ample discussion is given to appearance of color in living forms and how to create color within the body by depositing layers of translucent material (celluloid, cellulose acetate) containing varying amounts of pigment inside a mold of the object to be reproduced. Primarily discusses and illustrates amphibian and reptile work but touches on the use of this system to replicate bird parts (bills, feet, and bare areas) and a system of casting and hair transference in mammals that are sparsely haired and require good surface detail.

879 White, J. B., and L. L. Pray. 1962. Paper sculpture for the taxidermist. Modern Taxidermist, Greenfield Center, New York. 56 pp.

Based on an article originally written by Bob White in 1941 for *Modern Taxidermist* magazine and enlarged in this publication. Describes molding and casting objects, how to make papier mâché and paste and its proper use, paper sculpture, mounting fish, and how to make a mannikin by laying up heavy building paper. The latter achievement was an improvement over the Akeley plaster and burlap forms of years past.

880 Williamson, B., J. Hall, and D. Blair. 1986. The Breakthrough habitat and exhibit manual. Breakthrough Publishing Company, Monroe, Georgia. 156 pp.

Excellent manual for creating habitat materials used to enhancing mounts and in diorama construction. Describes available materials and tools, the use of reference material, design and composition, molding, habitat construction, artificial water, etc. At this time a truly one-of-a-kind manual.

XXVIII. FREEZE DRY PRESERVATION

Included in this section is an assortment of papers discussing the value of freeze-drying specimens for scientific preparation and taxidermy. Special reference should be made to the publication by Hower, 1979 (No. 889), who was one of the major pioneers in this field.

881 Altig, R. 1975. Freeze-drying anuran tadpoles for taxonomic examinations. Herpetology Review, 6(1):13.

Short note extolling the value of a freeze dryer for preparation of tadpoles. This system allows examination of structures such as oral disks which are not preserved well by any other method.

882 Bryn, K. 1972. Freeze-dry taxidermy. Science Digest, 72(1):39-43.

Popular article describing the theories behind freeze-dry preservation of specimens which was developed because of a lack of quality taxidermists. Also describes the use of the machine at the Smithsonian and New York State Museum, as well as some of the possible future uses. Contains no technical data.

883 Hankins, E. A. 1983. Examining warpage. Freeze-dry World, 1:21, 22, 31.

Discusses warpage, one of the problems that can occur in preparing natural history specimens by freeze drying. A number of suggestions are offered to prevent warpage of such areas as lips, mouths, toes, ears, etc., as well as methods to correct warpage once it occurs.

884 Harris, R. H. 1964. Vacuum dehydration and freeze drying of entire biological specimens. Annals and Magazine, Natural History Series 13, 7:65-74.

Presents a brief history of freeze drying and vacuum dehydration and describes two simple setups used experimentally at the British Museum (Natural History). Discusses results obtained in the study and theorizes improvements in the technique. A toad freeze dried for one year was later able to be relaxed, fixed, processed in traditional methods, and examined microscopically with good results.

885 Hower, R. O. 1964. Freeze-drying biological specimens. Museum News Technical Supplement no. 1. 8 pp.

Semi-technical paper on freeze drying specimens. Hower gives a short history and description of the process and the individual components of a freeze drying unit, along with suggestions on how to make a small apparatus.

886 Hower, R. O. 1967. The freeze-dry preservation of biological specimens. Smithsonian Institution, Proceedings of the United States National Museum, 119(3549):1-24.

Similar to the preceding paper only containing more technical data.

887 Hower, R. O. 1969. Freeze-dry preservation of biological museum specimens. American Taxidermist, 2(2).

Not seen. Citation from Hower, 1979 (No. 889).

888 Hower, R. O. 1970. Advances in freeze-dry preservation of biological specimens. Curator, 13(2):135-152.

This article was basically an update on the technology available at the time as well as a description of the progress made in freeze drying specimens for exhibit at the Smithsonian Institution. Contains a discussion of the problems of formaldehyde and also a report on freeze drying a water-soaked book from 1865.

889 Hower, R. O. 1979. Freeze-drying biological specimens: a laboratory manual. Smithsonian Institution Press, Washington, DC. 196 pp.

The classic work for freeze drying specimens. R. Harris describes succinctly the history of freeze drying in the introduction. Hower then proceeds to cover thoroughly the theory, instrumentation, and technical information necessary to prepare scientific specimens by this process. Contains many illustrations of dried vertebrates and invertebrates which show the success of this system in creating reasonably good exhibit material. Includes directions for making glass eyes and an extensive bibliography on freeze drying.

890 Kulis, J. 1977. Freeze-dry taxidermy: myth vs. fact. American Taxidermist, 11(1):4-13.

Reports on the success of one particular shop using freeze-dry taxidermy. Kulis was one of the first commercial taxidermists to shift into freeze drying specimens. Freeze drying allowed elimination of tanning for mounting previously caped skins. Fresh specimens could be freeze dried whole or partially skinned, with preparation required for only the skull and appendages. Numerous illustrations are provided but contains little technical data.

891 Lossin, R. 1980. Anything new in freeze drying? Pp. 72-73, *in* 1980 Conference of Museum Preparators, The Australian Museum, Sydney. 160 pp.

Describes the freeze drying of the head skin, hands, and feet of a gorilla for mounting. The head was separated from the body, skinned, fleshed, fixed for four hours in 5% formalin, and rinsed in water. A thin plaster cast of the skull was made, the flesh parts or the eyes modeled in epoxy putty, and the skin laid over. The skull was freeze dried, the plaster liner removed and replaced with polyurethane foam, and the head fitted to the conventionally-made mannikin. The hands and feet were also skinned out, modelled in putty, freeze dried, and later attached to the mannikin.

892 Meryman, H. T. 1960. The preparation of biological museum specimens by freeze-drying. Curator, 3(1):5-19.

The first substantial American paper on freeze drying whole vertebrates and invertebrates for display. A good discussion is given on the theory and machinery of freeze drying. The method for posing was to freeze the joints solid with liquid nitrogen (now generally replaced by a system of wires). A number of examples of freeze dried vertebrates and invertebrates are illustrated.

893 Meryman, H. T. 1961. The preparation of biological museum specimens by freeze-drying. II. Instrumentation. Curator, 4(2):153-174.

Supplies much more technical information on the theory and practice of freeze drying as introduced in the previous paper. Contains graphs for drying times of various vertebrate groups and numerous tables on vapor pressure, drying times, insulation, vacuum pumps, etc. Thoroughly discusses the machinery necessary to create a functional freezer dryer.

894 Norton, I. 1980. Freeze drying as a method of preparation at the Queen Victoria Museum. Pp. 74-78, *in* 1980 Conference of Museum Preparators, The Australian Museum, Sydney. 160 pp.

Reports on various techniques developed to improve the freeze drying of specimens. Describes using a syringe to inject clay into eye sockets to set glass eyes. Dacron fiber is used to replace the internal organs and brain, both removed through a very small cut in the abdomen. Describes a method of partially skinning

the carcass and placing a layer of borax under the skin when removing the subcutaneous fat. Also describes freeze drying frogs in the mating position.

895 Phillips, A., and B. Phillips. 1981. The art of freeze dry taxidermy. Archie Phillips, Fairfield, Alabama. 92 pp.

The book describes some of the methods used in freeze dry preservation. Covers various aspects of preserving fish, mammals, birds, and reptiles using combination and complete freeze dry taxidermy. A short chapter is included on the history of freeze dry taxidermy. Much of the book is made up of photos of mounts and procedures in mounting with little actual written information.

896 Reshetniak, P. 1978. Lyophilization in your future. Taxidermy Review, 7(2):38-43.

Popular article presenting some of the information relating to the controversy between freeze drying and conventional taxidermy. The author points out, among other things, that there are still potential problems with fat deposits despite the use of antioxidants, and that a freeze dry machine does not produce specimens of high quality unless the technician is as skilled as a professional taxidermist.

897 Romero-Sierra, C., J. C. Webb, P. Lane, and W. Lyons. 1983. Preservation of biological specimens by freeze-drying techniques. Pp. 57-63, *in* Proceedings of 1981 Workshop on Care and Maintenance of Natural History Collections (D. J. Faber, ed.), Syllogeus no. 44, National Museums of Canada, Ottawa, Canada. 196 pp.

Details the preparation of a cat by freeze drying for use in teaching anatomy in university courses. Specimens are drugged, perfused with an anticoagulant and vasodilator, exsanguinated, injected with latex, then dissected to the appropriate stage and wrapped, followed by freeze drying and further procedures.

898 Romero-Sierra, C., J. C. Webb, G. W. Lyons, J. K. Desmarteau, and K. C. Carlson. 1986. Preparation of freeze-dried hearts for use as teaching aids. Collection Forum, 2(2):11-13.

Reports on the use of freeze drying in the preparation of hearts for use in teaching anatomy at the university level. This system offers numerous advantages over the one which utilizes specimens preserved in formalin or alcohol.

899 Tenedini, K. 1986. Fats -- antioxidants. Their nature and properties. Taxidermy Today, 8(4):78-79.

Briefly discusses vertebrate fat deposits which remain in freeze dried specimens, then describes how antioxidants are used to combat this problem.

900 Tenedini, K. 1986. Freeze-drying -- a system of logical balance. Freeze Dry World/Taxidermy Today, 8(3):64-65, 67, 69.

Basic description of freeze drying as it relates to taxidermy.

901 Tenedini, K. 1988. Freeze drying -- What's really happening. American Taxidermist, 22(1):4-9.

Description for the layman of the activities that occur in a freeze-dry machine. Tenedini is currently one of the leading advocates of freeze-dry taxidermy.

SEE ALSO

Hankins, 1979 (No. 446)
Metcalf, 1981 (No. 725)
O'Conner, 1983 (No. 729)
Birontas, 1980 (No. 690).

XXIX. MAMMAL TAXIDERMY AND TANNING

This section includes publications which deal only with mammal taxidermy and tanning. Minor articles in recent years are not included. Reference should also be made to Division XXIV, General Taxidermy; Division XVII, Specific Techniques in Taxidermy; and Division XXXII, Mammal Preparation and Collection Management.

902 Budin, O. A. 1982. Spanish.

903 Clark, J. L. 1930. A new paste for applying mammal skins to manikins. Museum News, 8(11):11.

Describes a recipe for hide paste consisting of water, dextrine, paper pulp, and whiting, which the author considered superior to the flour and glue paste of Akeley. This formula is very similar to that devised by Freisser, 1931 (No. 914), but lacks chemicals to allow storage (phenol) and insectproofing (arsenic) found in this latter recipe.

904 Crandall, F. 1976. Symmetric system of big game head mounting. The Jonas Technique. Volume 3. Jonas Brothers, Inc., Denver, Colorado. 82 pp.

Not seen. Citation from Jonas Brothers catalogue.

905 Dahmes, S. 1987. The Sallie Dahmes whitetail/mule deer taxidermy system. Breakthrough Publishing Company, Monroe, Georgia. 160 pp.

Not seen. Description based on advertisement. A complete start-to-finish system for mounting whitetail and mule deer. Over 800 photographs and diagrams. For the commercial taxidermist.

906 Deutsche Künstlervereinigung der Museumsdermoplastiker (DEUKÜMAS). 1931. German.

907 Dill, H. R. 1932. Mounting mammal ears over cast forms. Museum News, 10(1):6.

Probably the first paper describing the use of a paper cast of the ear cartilage in medium and large mammal skins. The method of placement is archaic because the form was admitted from the outside by splitting the front and back of the ear.

908 Dill, H. R. 1932. Mounting large mammals without opening cuts in the legs. Museum News, 10(2):7-8.

Describes the creation of a manikin of a large mammal (in this case, a lion) in three easily assembled pieces so that the mammal can be mounted using only a single abdominal cut.

909 Dill, H. R. 1937. Laboratory methods of mounting small and medium-sized mammals. Museum News, 14(15):6-8.

Very excellent article on mounting small to medium-sized animals. The techniques described are very involved but produce excellent results. One innovation is to use a plaster face mask mold to create a direct cast of the actual nose structure from bees wax onto the skull. The limbs are made from individual pieces of balsa wood for each section of the leg. Ear cartilages are cast and replaced or made completely artificial.

910 Dill, H. R. 1950. Mounting of small and medium-sized animals. Museum News, 27(20):6-7.

Very similar to the preceding paper from 1937 except that a few slight modifications were made. Two steps were eliminated in casting the wax head.

Also, Dill no longer recommended sulfuric acid/salt tanning and tans directly in 50% grain alcohol:50% turpentine.

911 **Dill, H. R. 1958. Mounting large mammals. Museum Graphic, 10(3):18-19.**

Short description on mounting large mammals using a hyena as an example. Insufficient information is given to be of much use.

912 **Dipel, H. 1971. Tanning large skins for mammal collections. Commonwealth Scientific and Industrial Research Organization (CSIRO), Division of Wildlife Research, Technical Memorandum, 7:1-25.**

Basic description of one method of tanning mammal skins. Information on skinning, salting, fleshing, shaving, softening, alum tanning, oiling, and finishing. Also discusses an experiment on color retention and the tanning of large bird skins.

913 **Dyche, L. L. 1908-09. On the care of mammal skins kept for museum purposes. Transactions of the Kansas Academy of Science, 22:363-368.**

The author describes his techniques and experience in handling skins of mammals prior to their preparation as taxidermy mounts. Dyche was one of the premiere taxidermists in America beginning in the 1880s, working at the University of Kansas.

914 **Freisser, J. 1931. Recipe for stock paste and cement. Museum News, 9(5):8.**

Describes the materials and methods used to make hide paste. This formula can also be thickened with asbestos and whiting to be used as a mâché. Freisser was one of the best taxidermists in this century and this formula which he developed in 1912 was used by most taxidermists of that era as well as up to the present (Lossin and Hangay, 1977, No. 922).

915 **Gromme, O. J. 1929. An aid in handling field measurement charts and records. Museum News, 7(11):7-8.**

Presents a method of keeping organized data sheets of mammal measurements in the field by use of printed measurement charts and data sheets that fit in three-ring notebooks. Illustrates a sample chart of 34 measurements taken on a lion body for later mannikin reconstruction. A more detailed (but less available) version of this paper was published in the Yearbook of the Public Museum of the City of Milwaukee, 1928, Volume 8:569-575.

916 **Hangay, G. 1980. Home tanning. Pp. 99-108, *in* 1980 Conference of Museum Preparators, The Australian Museum, Sydney. 160 pp.**

Describes the basic procedures of tanning with adequate information to cover the subject. Describes preparing the skin, fleshing and shaving, degreasing, pickling, staking and finishing. Provides a number of recipes used in tanning to illustrate some of the variety in methods and specialized techniques for certain tanning methods.

917 **Hegenauer, H. 1982. Swedish.**

918 **Jonas, L. 1930. The mounting of an elephant group. Proceedings of the American Association of Museums, New Series, no. 11, Washington, DC. 30 pp.**

Elephant taxidermy in its finest form. This is the best description of the Akeley method of mounting elephants, perhaps his greatest accomplishment. Louis Jonas was Carl Akeley's first assistant during the greater part of construction of the

elephant group in the African Hall in the American Museum of Natural History. In this article, Jonas describes this method with illustrations as used on Indian elephants for the same museum. Also summarizes the history of elephant taxidermy.

919 Kerz, F., and J. Kerz. 1912. German.

920 Kish, J. 1978. The Jonas technique. Volume II. Mammals, anatomy, sculpture and mounting. Jonas Brothers, Inc., Denver, Colorado. 105 pp.

Excellent American mammal taxidermy text. Even now, it is surpassed in English only by Hangay and Dingley 1985 (No. 067), which used much of the same information and photographs. Kish thoroughly covers all aspects of mammal taxidermy using a classic approach; i.e., he doesn't commercialize the techniques by using bought forms. Information is given on anatomy, small and large mammal taxidermy, tanning, and rugmaking.

921 Lossin, R. 1980. New methods in large mammal taxidermy. Pp. 127-131, *in* 1980 Conference of Museum Preparators, The Australian Museum, Sydney. 160 pp.

Briefly discusses some techniques for making mannikins currently in use, their pros and cons. These include polyurethane foam inside a mold of a sculpture, direct application of polyurethane (see Lossin and Hangay, 1977, No. 922), polyester resin body casts, paper forms and commercially made mammal bodies. Also briefly discusses reproduction of mammals like rhinos, hippopotamus, and elephants with polyester resin.

922 Lossin, R., and G. Hangay. 1977. Mounting a black bear. Kalori no. 52:43-45.

Describes mounting a large mammal by directly forming a mannikin of polyurethane foam. A frame was constructed out of wire, wood, chicken wire, and screen. Two components of polyurethane were next sprayed onto the frame and allowed to foam. The resulting form was carved and sanded to size then covered with a cheesecloth layer dipped in plaster. Other details are described.

923 Pagel, L. 1983. Swedish.

924 Pagel, L. 1984. German.

925 Phillips, A., and B. Phillips. 1980. How to mount deer for profit or fun. Stackpole Books, Harrisburg, Pennsylvania, 127 pp.

Not seen. Citation from advertisement. Provides details on mounting a deer -- skinning, cape preparation, forms, methods, etc.

926 Phillips, A., and B. Phillips. 1983. How to mount lifesize animals. Published by author, Fairfield, Alabama, 320 pp.

Despite the size of this book, only a small amount of good information is contained in the text. The author interviewed and photographed a large number of commercial taxidermists in many states and the book is a compendium of methods used by them. Certain articles contain a few new ideas, but in general, insufficient detail is given about these ideas. Most of the book would be of no use to museum taxidermists.

927 **Pray, L. L. 1956. The squirrel mounting book. Third edition. Modern Taxidermist, Greenfield Center, New York.**

Not seen. Citation from advertisement flier which describes the contents as "...complete formulas for paste, mâché and borax solutions; skeleton sculpture, balsa, and excelsior forms; skinning and tanning methods..."

928 **Pray, L. L. 1966. The mammal mounting book. Second edition. Modern Taxidermist, Greenfield Center, New York.**

Not seen. Citation from advertisement flier which describes it as written for the beginning taxidermist or hobbyist.

929 **Saslavsky, M. A. 1964. Russian.**

930 **Spurlock, G. M. 1980. Home tanning methods. University of California Division of Agricultural Sciences Leaflet no. 21005. 34 pp.**

Excellent small manual on tanning methods. It covers all aspects of tanning and leathermaking, and gives information on a multitude of tanning methods: vegetable tanning, mineral tanning, chrome tanning, alum tanning, salt-alum-acid variations, glutaraldehyde tanning, etc.

931 **Thietje, W. C., and G. D. Schrimper. 1967. Laboratory techniques for mounting rabbits and other small mammals. Museum News, Technical Supplement no. 16. 4 pp.**

Very excellent article on mounting rabbits with most techniques applicable for other small to medium-sized mammals. A good description is given for creating a face mask and transferring a wax mold of the face to the actual head mannikin, then adjusting the details. This procedure was previously described in Dill, 1937 (No. 909) and Dill, 1950 (No. 910).

932 **Williamson, B., T. Sexton, and K. Edwards. 1986. The Breakthrough Whitetail Taxidermy Manual. Breakthrough Publishing Company, Monroe, Georgia. 112 pp.**

Reasonably good manual on whitetail taxidermy applicable primarily to improving the methods of a commercial taxidermist. Provides a number of innovative ideas along this line but assumes the use of commercial forms and doesn't give information for original creations.

XXX. TAXIDERMY OF AMPHIBIANS, REPTILES, AND FISH

The majority of papers in this section detail fish taxidermy both by traditional skin techniques or by cast reproductions in various media. This latter method is actually over 80 years old, though there have been numerous improvements in techniques (see especially Billard, 1984, No. 933). Many of the methods used on fish are equally applicable to amphibians and reptiles.

933 Billard, R. S. 1984. Ralph C. Morrill's museum quality fish taxidermy. BillArt Publications, Rowayton, Connecticut. 257 pp.

Reviewed in *Breakthrough* no. 11, pp. 58-59, by T. Sexton who felt it was the most comprehensive book on molding and casting techniques ever written. This book should be in every library as a basic reference. Contains some spectacular color photographs.

934 Chan, G. 1961. An ancient method of fish mounting. American Biology Teacher, 23:436-438.

Describes a technique of salting and drying whole fish for use in school biology programs. The finished product is sturdy but greatly distorted from appearance in life.

935 Dill, H. R. 1959. Preparing reptiles and amphibians for exhibition. Museum Graphic, 11(3):15-18.

Though only a short article, the author does an adequate job of describing preparation of herptiles. Smaller specimens are cast from plaster in either wax or latex. Turtles are mounted using the leg, skins, and shell, and alligators are done similarly. Contains some nice illustrations of casts and mounts.

936 Farmer, W. M., and G. P. Ives. 1965. How to prepare fiberglass fish for museum displays. Museum News Technical Supplement no. 9, 44(2):47-50.

Basic description of the casting of marine fish to make fiberglass reproductions for an underwater diorama and other displays at the San Diego Natural History Museum.

937 Fowler, C. P., Jr. 1969. Preserving cold-blooded vertebrates for air display. Turtox News, 47(5):154-156.

Describes the killing and fixing of reptiles and amphibians and the formation of dried mummies coated with clearacryl and polyurethane. A poor method of preparing specimens.

938 Hjortaa, H. 1968. Danish.

939 Hutterer-Niedereder, A. 1978. German.

940 Migdalski, E. C. 1981. Fish mounts and other fish trophies -- the complete book of fish taxidermy. Second edition. John Wiley and Sons, New York. xi + 212 pp.

Written primarily for the sports enthusiast who wishes to preserve his fish trophies. Includes information on field care, producing reproductions, traditional skin mounts, painting, museum exhibits fish expeditions, etc. Nicely illustrated.

941 Moore, W. E. 1975. Mount your own fish trophies. Doubleday and Co., Garden City, New York, 79 pp.

Not seen. Citation from Carnegie Library of Pittsburgh.

942 **Noble, G. K., and M. Jaeckle. 1926. Mounting by paraffin infiltration. American Museum Novitates, 223:1-7.**

Initial paper in English describing the mounting of amphibians and reptiles by infiltration with paraffin. The process was invented in Vienna but the techniques were not published. The authors developed their own method by experimenting with various fixing fluids and cleaning solutions based on histological techniques. The basic information on this technique was reprinted in the Museums Journal in 1929.

943 **O'Conner, P. circa 1975. Fish taxidermy. Watkins & Doncaster, Hawkhurst, England. 30 pp.**

Not seen. Citation from Morris, 1984 (No. 1221).

944 **Phillips, A., and B. Phillips. 1979. How to mount fish. Stackpole Books, Harrisburg, Pennsylvania. 133 pp.**

Not seen. Citation from Morris, 1986 (No. 1222). Details on mounting fish, new techniques, and fiberglass reproductions.

945 **Pray, L. L. 1956. The fish mounting book. Second edition. Modern Taxidermist, Greenfield Center, New York. 60 pp.**

Not seen. Citation from advertisement flier which describes it as the "last word on the subject of stuffing fishes."

946 **Schmidt, R. H. 1971. How to mount fish. Emporia State Press, Emporia, Kansas. 32 pp.**

Not seen. One reviewer described it as an excellent beginners/hobbyists text. Covers the "filler method" well.

947 **Sexton, T. 1988. The Tom Sexton fish finishing system. Breakthrough Publishing Co., Monroe, Georgia. 116 pp.**

Not seen. Description based on WASCO advertisement. An in-depth guide to finishing a mount: painting, rebuilding sunken areas, eye setting, etc. Over 400 photos with 16 pages in color.

948 **Spacer, J. A. 1965. Silastic process for casting amphibians, reptiles and fish. Museum News Technical Supplement no. 9, 44(2):52-53.**

Describes the use of silastic RTV, a relatively new silicon-rubber compound which was used to make flexible casts and molds of frogs, snakes, and fish.

949 **Wildlife Artist Supply Company. 1986. The Breakthrough fish taxidermy manual. Breakthrough Publishing Co., Monroe, Georgia. 162 pp.**

Not seen. Description based on advertisement. Covers the entire topic of fish mounting: skinning, painting, reproductions, etc. Over 700 photographs.

950 **Wildlife Artist Supply Company. 1988. The Breakthrough fish painting encyclopedia. Breakthrough Publishing Co., Monroe, Georgia. 156 pp.**

Not seen. Description based on advertisement. Gives paint schedules for 58 North American fish species. No color Photographs. Updated revision of earlier manual.

951 **Witchard, R. 1980. Fish casting. Pp. 43-68, *in* 1980 Conference of Museum Preparators, The Australian Museum, Sydney. 160 pp.**

A well-written article which provides information on the casting of fish in plaster and the creation of artificial polyester resin reproductions. The author includes

a large number of tidbits of information which can come only from extensive experimentation with this procedure.

MANUSCRIPTS

952 Hall, J. C. circa 1980. Fish mounting. The Jonas technique. Volume 4. Jonas Brothers, Inc., Denver, Colorado.

Not seen. Incomplete manuscript written by Jim Hall for Jonas Brothers. Never published.

SEE ALSO

Walters, 1925 (No. 878).
Hicks, 1966 (No. 871).

XXXI. HISTORICAL PREPARATION

The major purpose of this section is to list publications on scientific preparation and taxidermy, written prior to 1900. These are particularly valuable for documenting methods and materials used which may help in management of extant collections from that era. This literature also can serve as a reservoir of information for innovative ideas on preparation or for modification of new techniques.

A second theme of this section is to present publications describing the history of scientific collecting and taxidermy. Many of these articles contain little information on actual preparation, but philosophies or ideas pertaining to preparation are often contained within. This literature is often difficult to locate and it is hoped that the listing below will encourage research in the area of historical preparation. (See especially Williams and Hawks, 1987, No. 1115.)

953 Adams, A., W. B. Baikie, and C. Barron. 1854. A manual of natural history for the use of travelers; being a description of the families of the animal and vegetable kingdoms with remarks on the practical study of geology and meteorology. To which are appended directions for collecting and preserving. John Van Voorst, Paternoster Row, London. viii + 749 pp.

Pages 623-631 describe collecting zoological specimens and the necessary preparation materials and formulas. Pages 632-656 describe collection and preparation of vertebrate skins and skeletons.

954 Allen, G. n.d. The taxidermist's manual containing complete instructions in the art of taxidermy with directions how to prepare mount and preserve all kinds of birds, animals and insects. Dick & Fitzgerald, New York.

Probably published in the late 1800s. Pages 11-39 describe various aspects of skinning, mounting, and finishing a bird.

955 Andes, L. E. 1894. German.

956 Anonymous. 1788. Italian.

957 Anonymous. 1795. Directions for preserving animals and parts of animals. No. III, pp. 8-9, *in* Appendix of Collections of the Massachusetts Historical Society for the Year 1795.

One of the earliest American references suggesting that collections of zoological material be made and what types of material are valuable for further study.

958 Anonymous. 1831. Short directions for the preparation, preservation, and also the transportation of mammiferous and amphibious animals, birds, fishes, etc. Senckenberg Institution for Natural History, Frankfurt, Germany. Translated by W. C. Woodbridge. American Journal of Science and Arts, 19:52-57.

Gives instructions for preserving vertebrates in spiritous liquor, preparing large mammal skins with salt and alum, small mammals and birds as study skins, and includes recommendations for insects and crustaceans. Gives the formula for arsenical soap.

959 Anonymous. 1884. Value of steam in taxidermy. Random Notes on Natural History, 1(2):1.

Describes a number of uses of steam in taxidermy -- softening wings or feet, restoring feathers, and relaxing previously mounted specimens.

960 Anonymous. 1884. Poisons and how to use them on birds. Random Notes on Natural History, 1(4):5-6.

Minor note giving details on how to use pure arsenic, a mixture of arsenic and alum, and arsenic soap to preserve bird skins.

961 Anonymous. 1885. Mammal skins. Random Notes on Natural History, 2(10):73-74.

Describes the preparation of mammal study skins.

962 Anonymous. 1899. How to mount a bird correctly. Oologist, 16(3):50-51.

Very brief instructions on basic bird taxidermy.

963 Avis, R. 1870. Bird preserving, bird mounting and the preservation of bird eggs. Groombridge and Sons, London. 48 pp.

Not seen. Citation from Morris, 1984 (No. 1221). Reprinted circa 1899, F. Warne and Co., New York.

964 Baird, S. F. 1846. Hints for preserving objects of natural history. (Dickinson College). Gitt and Hinkley, Carlisle, Pennsylvania. 12 pp.

Gives adequate instructions on preparation of study skins of birds, and summary instructions are given for quadrupeds, reptiles, fish, shells, insects, and plants. This booklet was probably written while Baird was a student at Dickinson or shortly thereafter. Baird later became director of the National Museum and arguably was the greatest protagonist of collecting vertebrates in United States history.

965 Baird, S. F. 1857. Directions for collecting, preserving, and transporting specimens of natural history. Annual Report, Board of Regents, Smithsonian Institution, Miscellaneous Document no. 54:235-253.

Written primarily for travellers so that they would have the necessary information to collect and prepare zoological, botanical, and mineralogical specimens, which were to be sent to the Smithsonian Institution. Baird had persuaded the War, Navy, and Treasury departments of the government to aid in transporting this material to Washington from the Atlantic, Pacific, and frontier posts that it may be assembled and studied to describe the flora and fauna of North America.

966 Bancroft, E. 1769. An essay on the natural history of Guiana in South America. T. Becket and P. A. DeHondt, London. 402 pp.

Pages 183-185 describe a method of preparation specimens of birds in Guiana for the cabinets of naturalists in Europe. The birds are first eviscerated and filled with salt and alum. Then the they are submerged for one to two days in a distillation of rum and dried in an oven.

967 Barber, L. 1980. The heyday of natural history, 1820-1870. Doubleday and Company, Garden City, New Jersey. 320 pp.

Fascinating text detailing the history of natural history through a very important era of science. Contains details of many of the major contributors to natural history of that era -- Audubon, Swainson, C. W. Peale, Waterton, etc., and traces many of the advances in museums during that time period.

968 Batty, J. H. 1880. Practical taxidermy and home decoration. Orange Judd Co., New York. 203 pp.

Excellent book on taxidermy with some information on scientific collecting. Good information for that time period. May be one of the first American books to describe a bird skin drying form and discuss habitat scenes, a reasonably new innovation.

969 Bedini, S. A. 1965. The evolution of science museums. Technology and Culture, 6(1):1-29.

Entertaining account of the history of science museums. Includes an excellent table of early science collections and museums in Europe and North America, their dates

of operation, and types of materials collected. Though written primarily for science and technology museums, it contains a good deal of information on natural history collections.

970 Beeton, S. O. 1877. Birds' nests and eggs and bird-stuffing. Beeton's Country Books, 2:289-352.

Amateurish book with little practical information. Only a few pages devoted to preparation.

971 Bergtold, W. H. 1928. Comments on an article appearing in "Military Surgeon" on some recollections of Dr. Elliott Coues. Auk, 45:541-542.

Reprints a portion of the recollections of Elliott Coues by H. C. Yarrow, describing Coues as a highly motivated ornithologist. Mentions a "skin-off" between Coues and a Mr. Henshaw in which both completed study skins of English sparrows in less than two minutes.

972 Berlind, M. 1964. Mr. Bickmore's birds. Museum News, 42(8):11-14.

A short popular article about Dr. A. S. Bickmore (the first superintendent of the American Museum of Natural History). Discusses the fate of some specimens Bickmore collected in the East Indies between 1865 and 1868 which now reside in Colgate. A long quotation from Bickmore about field conditions in collecting is thoroughly entertaining.

973 Boitard, M. 1859. French.

974 Boitard, M. 1881. French.

975 Boyle, R. 1666. A way of preserving birds taken out of the eggs, and other small fetuses. Philosophical Transactions, 12:199-201.

Perhaps the earliest account in English describing the preservation of fluid specimens, in this case a series of chicken embryos in spirits of wine.

976 (British Museum). 1837. Directions for collecting biological specimens. P. 97, *in* Hobart Town Courier. 6 April. Reprinted *in* 1986 Pacific Preparators Conference, Queen Victoria Museum and Art Gallery, Launcetown, Tasmania. 105 pp.

General directions written by the Trustees of the British Museum to encourage the collection of specimens. Details are given for mammals, birds, reptiles, fish, crustaceans, arachnids, insects, etc. Also includes the information on specimens requested and a recipe for arsenic soap.

977 Brown, T. 1851. The taxidermist's manual; or the art of collecting, preparing, and preserving objects of natural history. Designed for the use of travellers, conservators of museums, and private collectors. Tenth edition. A. Fullerton & Co., London. xii + 150 pp.

This booklet serviced an entire generation of taxidermists. According to Pat Morris, it was originally published in Glasgow in 1833 and printed unchanged to 1885 in well over 20 editions. A number of slightly different American editions were also printed. Captain Thomas Brown was very knowledgeable about this artform and was considered one of the better naturalists in England. It is a valuable historic reference in itself but also gives methods used by earlier or contemporary taxidermists of the time it was written -- Bullock, Becoeur, Mauge, Waterton, etc.

978 Browne, M. 1884. Practical taxidermy: a manual of instruction to the amateur in collecting, preserving, and setting up natural history specimens of all kinds. To which is added a chapter upon the pictorial arrangement of museums. Second edition. L. Upcutt Gill, London. 344 pp.

A complete book on taxidermy published by one of England's best taxidermists of the latter 1800s. The book was initially written in 1878, reprinted in 1879, and again in 1882 when it was 344 pages. The 1884 edition was a revised version with a larger format. A third edition was printed in 1922 revised and updated by G. Ebsworth Bullen.

979 Browne, M. 1896. Artistic and scientific taxidermy and modelling. A manual of instruction in the methods of preserving and reproducing the correct form of all natural objects, including a chapter on the modelling of foliage. Adam and Charles Black, London. xii + 463 pp.

The classic work of English taxidermy. It was the best book on this subject to come out of England until recent years and contained many new formulas for preservation. Was the first book to publicize the hazards of using arsenic, though this chemical continued to be used well into the twentieth century.

980 Bullock, W. 1817. A concise and easy method of preserving subjects of natural history, intended for use of sportsmen, travellers, &c. &c. to enable them to collect and prepare such curious and rare articles as they may wish to preserve, or to transmit in safety to any part of the world. Brown and Conn, London. approx. 45 pp.

Pages 5-11 describe skinning birds and preparing study skins, and pages 26-30 detail setting up fresh birds as taxidermy mounts. The remainder of the text describes work on fish, reptiles, botanical specimens, etc., and a description of the London Museum to which he was proprietor.

981 Bullock, W. 1818. A concise and easy method of preserving objects of natural history. Manuscript.

Not seen. Citation from Morris, 1984 (No. 1221). Reprinted in 1829.

982 Burns, N. J. 1940. The history of dioramas. Museum News, 17(16):8-12.

Traces the evolution of dioramas from the early medieval painter through the religious groups of the fifteenth century, the stage settings of the seventeenth and eighteenth centuries and panoramas of the nineteenth century. A small section is devoted to museum groups crediting Bullock with forming the first diorama and the idea expanded by Booth, M. Browne, Verreaux (though not by name), Hornaday, and others.

983 Burroughs, R. D. 1961. The natural history of the Lewis and Clark expedition. Michigan State University Press, East Lansing, Michigan. v-xii + 340 pp.

The forward discusses the importance of the Lewis and Clark expedition and the specimens that came from that momentous trip. Jefferson requested the specimens be sent to Peale's museum in Philadelphia, where they were used along with others by Alexander Wilson, who was then writing his book entitled American Ornithology.

984 Burton, W. 1891. An easy way of making one hundred pounds sterling a year in collecting specimens of natural history at leisure time. The Humming Bird, January, February, March, April, July, 1891. Pp. 7, 15, 23, 31, 32, 56, & 57.

Popular article describing field collection and preparation of zoological specimens which were to be sent back to England. The portion on bird study skin preparation is well written for the time period.

985 Capus, G. 1879. French.

986 **Capus, G., and A. T. Rochebrune. 1883. French.**

987 **Christy, M. 1888. Bird nesting and bird skinning. Unwin, London. 138 pp.**

Not seen. Citation from Morris, 1986 (No. 1222), who says it was originally written by E. Newman in 1862 and is mostly about eggs with a short chapter on skinning.

988 **Cole, F. J. 1944. A history of comparative anatomy. MacMillan, London.**

The definitive book on the subject including a history of specimens used for study of comparative anatomy. Discusses the first specimens preserved in fluid in 1662 and how this method grew to include preservation of large collections of fluid specimens. Also mentions many of the notable anatomical museums such as those of Ruysch, Hunter, the Ashmolan collection, etc. Reprinted in 1975 by Dover Publications, New York.

989 **Cutler, M. 1795. Doctor Cutler's method of preserving the skins of birds. No. IV, pp. 9-10, *in* Appendix of Collections of the Massachusetts Historical Society for the year 1795.**

Brief instructions on how to prepare a flat bird skin by skinning and drying it flat with a piece of paper inside, then anointing with alum, saltpeter, and black pepper, and drying for a period of several hours in an oven from which bread had just been removed.

990 **Cutler, M. 1795. A method of preserving birds and other animals from the Philosophical Transactions, recommended by Dr. Lettsom, in his Traveller's Companion, P 13. No. VI, pp. 11-12, *in* Appendix of Collections of the Massachusetts Historical Society for the Year 1795.**

Reprints selected portions of papers by Lettsom, 1774, (No. 1036) and Kuckahn, 1771 (No. 1032). Presumably this was done for an American audience who didn't have access to these English papers.

991 **Daudin, F. M. 1800. French.**

992 **Davie, O. 1894. Methods in the art of taxidermy. David McKay, Philadelphia. xiv + 352 pp. + index.**

One of the best taxidermy texts written in 19th century America. The historical introduction is excellent and shows that Davie was well versed in historical and world methods. The text is also very well put together with all topics covered thoroughly. Contains numerous illustrations.

993 **Davies, J. B. 1858. Naturalists' guide. Edinburgh.**

Not seen. Citation from Kingsley, 1882 (No. 1030).

994 **Davies, T. 1771. A letter from Captain Davies to John Ellis, Esquire, F. R. S., on a method of preparing birds for preservation. Philosophical Transactions of 1770, 60:184-187.**

Describes a very early method of preparing a bird mount. The method outlined is to eviscerate the specimen and pack this area with cotton soaked in camphire (camphor) dissolved in spirit. Then the tongue, brains, and eyes are removed via the mouth and the head packed similarly. Eyes are fashioned by black candle wax drops on paper. A simple wire system is then used to set up the bird.

995 **Davis, N. L. 1893. Hints on skinning and mounting birds. Oologist, 10(3):86.**

The author offers a number of common tips on bird taxidermy.

996 **Dolph, J. A. 1975. Bringing wildlife to millions: William Temple Hornaday, the early years 1854-1896. University of Massachusetts Ph.D. dissertation. University Microfilms, 76-5848.**

Not seen. Citation from Morris, 1984 (No. 1221).

997 **Donovan, E. 1794. Instructions for collecting and preserving various subjects of natural history. Privately published, London. 86 pp. (Translated by J. J. Romer).**

Eight pages are devoted to a brief description of the methods of mounting birds and mammals used by this German naturalist. The system of wiring up a bird mount seems unique but most of the other methods used are similar to those of that era.

998 **Dorveaux, P. 1924. French.**

999 **Dufresne, L. 1820. French.**

1000 **Duges, A. 1981. Spanish.**

1001 **Eger, L., and M. Lessona. 1885. Italian.**

1002 **Engelmann, W. 1846. French.**

1003 **Evans, P. 1850. French.**

1004 **Facklam, M. 1968. Behind these doors: science museum makers. Rand McNally and Co., Chicago. 143 pp.**

Popular book about museums, their founders, and activities that go on in them. Provides some early history of the museums in England and the United States, on Henry Ward, and on early taxidermists.

1005 **Farber, P. L. 1977. The development of taxidermy and the history of ornithology. Isis, 68(244):550-566.**

Extremely well-researched paper tracing the evolution of taxidermy from Reaumer (circa 1750) through the early 19th century. The conclusion arrived at was that preserved specimens formed the basis for the science of ornithology, and it was only when taxidermists devised the mothproofing system which used arsenic that scientists of subsequent generations could build upon earlier works.

1006 **Farber, P. L. 1980. The development of ornithological collections in the late eighteenth and early nineteenth centuries and their relationship to the emergence of ornithology as a scientific discipline. Journal of the Society of Bibliography and Natural History, 9(4):391-394.**

Not seen. Citation from Morris, 1984 (No. 1221).

1007 **Feddersen, A. 1878. Danish.**

1008 **Flower, W. H. 1898. Essays on museums and other subjects connected with natural history. MacMillan and Co., Ltd., London.**

1009 **Forster, J. R. 1771. A catalogue of the animals of North America containing an enumeration of the known quadrupeds, birds, reptiles, fish, insects, crustaceous and testaceous animals; many of which are new, and never described before. To which are added short directions for collecting, preserving, and transporting all kinds of natural history curiosities. B. White, London. 51 pp.**

Pages 35-43 give a very brief description of how to preserve zoological, botanical, and mineralogical specimens. For birds, the system was very similar to that of Davies, 1771 (No. 994). This paper was reprinted in 1882 by the Willughby Society, London (P. L. Sclater, ed.)

1010 Frost, C. 1981. Victorian taxidermy: its history and finest exponents. Enchanted Aviaries, Long Medford, Suffolk. 48 pp.

Not seen. First attempt by this author to record information obtained while buying, selling, and collecting taxidermy cases from the Victorian era.

1011 Frost, C. C. 1987. A history of British taxidermy. Published by author. The Enchanted Aviary, Sudbury, Suffolk, England. 157 pp.

Very excellent book documenting the history of taxidermy in Britain up through the Victorian era and recording most (if not all) of the important commercial taxidermists who operated during this period. The author has been a collector of taxidermy cases (primarily birds) for over 30 years and has operated a business of buying and selling cases for half that time while keeping meticulous records of cases, techniques, trademarks, etc. During this era of taxidermy, 1820-1900, Britain, along with Germany, was a world center of taxidermy, having taken over from the French and later relinquishing to the Americans, so this document is invaluable for describing that time. A great deal of knowledge is covered on such notable taxidermists as the Ward family, John Handcock, Charles Waterton, John Gould, Thomas Gunn, and dozens of lesser known artists. Copiously illustrated, entertaining, and well written.

1012 Gannal, J. N. 1838. History of embalming, and of preparations in anatomy, pathology, and natural history; including an account of a new process for embalming. (Translated from French with notes and additions by R. Harlan, published in 1840 by Judah Dobson, Philadelphia, Pennsylvania). 264 pp.

Pages 168-196 give the formulas used for preparing and preserving specimens by naturalists. Formulas given include those of Becoeur, Mouton, Nicholas, Naumann, etc. Also reviews methods of tanning, injection, fluid preservation, embalming, and bone preparation of specimens.

1013 Gardner, J. 1870. Taxidermy made easy; being plain and practical directions for preserving, setting up and embellishing in the most approved style all kinds of quadrupeds, birds, fishes, reptiles, insects, etc., with notes and illustrations, designed for the use of private individuals, museums, etc. Fourth edition. Published by the author, London. xiv + 88 pp.

Not seen. Citation from Lucas, 1882 (No. 1218). Other editions published in 1865 and later in 1880.

1014 Green, H. O. 1934. The Crane embalming fluid formula. Oologist, 51(7):84-85.

In response to an earlier inquiry about the methods of embalming to create taxidermy mounts (Oologist, 51(1):9-10), Green published the Crane formula of embalming which consisted of a number of poisonous chemicals. A similar formula used in Michigan was also published, but no techniques were given as the procedure was of historical interest only.

1015 Gütebier, T. 1978. German.

1016 Gütebier, T. 1989 (ms). German.

1017 Haar, D. der. 1898. Dutch.

018 Hallock, C. 1877. The sportsman's gazetteer and general guide. The game animals, birds and fishes of North America: their habits and various methods of capture. Copious instructions in shooting, fishing, taxidermy, woodcraft, etc. together with a directory to the principle game resorts of the country; illustrated with maps. Forest and Stream Publishing Company, New York, New York. 688 + 208 pp.

Fascinating old book on sporting activities in the last century. A short chapter (pages 653-658) presents information on bird skin preparation, bird and mammal taxidermy, and tanning. A bibliography for sportsmen (pages 659-667) includes a good selection of texts available at that time for taxidermy and identification of birds, mammals, etc.

1019 Hangay, G. 1980. Stuffed with life. Pp. 110-119, *in* 1980 Conference of Museum Preparators, The Australian Museum, Sydney. 160 pp.

General article about the beginning and development of taxidermy. Some of the contributors mentioned include the Egyptians, Abbé Manesse, Becoeur, Charles Waterton, Rowland Ward, Carl Akeley, and Leon Pray. Also discusses the current status of taxidermy in the world.

1020 Hangay, G. 1980. Historical taxidermy specimens in the Australian Museum. Pp. 120-126, *in* 1980 Conference of Museum Preparators, The Australian Museum, Sydney. 160 pp.

Short article describing some old, well-made specimens in the Australian Museum. The first is a lion probably mounted by Carl Akeley and purchased from Ward's Natural History establishment in Rochester, New York. The second was the first sculpture taxidermy in the museum (acquired in 1922), an almost faultless bull dog specimen. Also illustrates an example of the German grotesque school of taxidermy.

1021 Harting, J. E. 1871. Hints on shore shooting; with a chapter on skinning and preserving birds. John Van Voorst, Paternoster Row, London. 88 pp.

Chapter 7, pages 79-88, details basic instructions for skinning and preserving birds as study skins.

1022 Hénon, J. L., and J. P. Mouton-Fontenille. 1802. French.

1023 Henry, J. 1859. Directions for collecting, preserving, and transporting specimens of natural history prepared for the use of the Smithsonian Institution. Third edition. Smithsonian Miscellaneous Collections, 2(7):1-40.

Written primarily by S. F. Baird, this publication is similar in content to that written in 1857 by him (No. 965). It covers thoroughly all aspects of collecting, preserving, and transporting all types of animals, vegetables, and minerals.

1024 Hornaday, W. T. 1921. Taxidermy and Zoological Collecting. A complete handbook for the amateur taxidermist, collector, osteologist, museum-builder, sportsman and traveller. Seventh edition. Charles Scribner's Sons, New York. xxi + 364 pp.

One of the best American taxidermy texts from the latter 1800s through the first half of this century. Covers all aspects of scientific collecting and taxidermy. Invaluable for its documentation of methods used during this period as it probably was the most common reference used. (Hornaday's book served as the basis of Elwood's correspondence course in taxidermy began in 1904, No. 701) Originally published in 1891 and contained xix + 362 pages, and later published in 1904 with xxi + 364 pages and called the seventh edition, though little text was changed.

1025 Hoxie, W. 1876. Taxidermy. Journal of Education, 4(6):61-62.

Article from a series of short papers on taxidermy. This portion on skinning a bird and making a study skin. Not particularly well done.

1026 Hunter, J. 1861. Essays and observations on natural history, anatomy, physiology, psychology and geology. Volume 1. John Van Voorst, Paternoster Row, London. 400 pp.

Pages 384-400 give instructions for making anatomical specimens by injection, corroded preparations, dry preparations, and embalming, primarily for comparative anatomical study.

1027 Issel, A., and R. Gestro. 1880. Italian.

1028 Jardine, W. circa 1848. Hints for preparing and transmitting ornithological specimens from foreign countries. Pp. 3-13, *in* Contributions to Ornithology, 1848-1852. Samuel Highley, London. 163 pp.

Written primarily for the world traveller so that he would be able to collect specimens in foreign countries to bring back to England. Excellent information is conveyed on how to skin birds, collect and blow eggs, prepare skeletons, and make fluid specimens. A recipe for arsenic soap was obtained from Gould who had recently used it while collecting birds on an Australian trip.

1029 King, H. 1840. Directions for making collections in natural history prepared for the National Institution for the Promotion of Science. Gales and Seaton, Washington, DC. 24 pp.

Contains basic instructions for collecting all manner of natural history specimens. It is interesting to note that the author suggests the collection of skulls of man, particularly from aboriginal nations, with help from frontier posts. Information is also presented on quadrupeds, birds, reptiles, etc.

1030 Kingsley, J. S. 1882. The naturalist's assistant. A handbook for the collector and student with a bibliography of fifteen hundred works necessary for the systematic zoologist. S. E. Cassino, Boston.

Pages 1-19 give the basics for collecting natural history specimens including skeletons, nests, and eggs of birds. The vast portion of the paper is devoted to the listing of systematic works, some of which include sections on natural history collecting. Reprinted in 1892.

1031 Kohlstedt, S. G. 1988. Curiosities and cabinets: natural history museums and education on the antebellum campus. Isis, 79:405-426.

Fascinating article describing the origins of natural history cabinets in colleges and universities from the beginning of the United States as a nation through the mid 1800s. The author discusses various contributions by individuals (such as S. F. Baird, D. McClure, P. Cleaveland, J. Henry, etc.) and traces the development of institution collections (Princeton, Brown, Williams, Dickenson, etc.) as they relate to curricula, students, societies,etc.

1032 Kuckhan, T. S. 1771. Four letters from Mr. T. S. Kuckhan, to the president and members of the Royal Society, on the preservation of dead birds. Philosophical Transactions of 1770, 60:302-320.

The first letter reviews three ways of preserving birds: eviscerated dried mummies, fluid preservation, and skinned specimens. The second letter gives suggestion for when birds should be collected and how they should be set up to appear lifelike. Letter three describes two formulas, one for a liquid varnish, and the other for a dry compound containing corrosive sublimate, saltpeter, alum, sulfur, musk, black pepper, and tobacco. The fourth letter describes Kuckhan's method of preparing mounted birds.

1033 Lawrence, M. A. 1987. Zoological collection Incunabula: the Wied Brazilian collection. Collection Forum, 3(1&2):16-18.

Traces the development of a research collection at the American Museum of Natural History. The first substantial collection in the museum was the Wied collection and its history is used as a model to discuss the typical history of a collection from this era. Also mentions some of the policy changes and budgetary problems the American Museum of Natural History has had over the years.

1034 Lecoq, H., and A. Boisduval. 1826. French.

1035 Lee, S. B. 1823. Taxidermy: or, the art of collecting, preparing and mounting objects of natural history. Third edition. Longman, Hurt, Orme, and Brown, London. 168 pp. + 5 plates.

The first complete manual of taxidermy in English. Probably a literal translation by T. E. Bowditch (1821) of the work by Dufresne, 1820 (No. 999). It continued to be published anonymously until the name Mrs. Sarah Wallis Bowditch Lee was mentioned in the sixth edition in 1845, after which time she took all credit for the work.

1036 Lettsom, J. C. 1774. The naturalist's and traveller's companion, containing instructions for collecting and preserving objects of natural history, and for promoting inquiries after human knowledge and in general. Second edition. E. & C. Dilly, London. xvi + 89 pp.

Appears to be a compendium of information obtained from all the recent works by naturalists of the day -- Turgot, Linnaeus, Forster, etc. The section on birds and other animals, pages 12-20, is mostly taken from Davies and Kuckhan with comments on, or improvements in, their methods. A third edition was published in 1799 though it contained few changes from the second edition.

1037 Leyland, J. 1866. Adventures in the far interior of South Africa including a journey to Lake Ngami and rambles in Honduras to which is appended a short treatise on the best mode of skinning and preserving birds, animals &c.; also receipts for making preservatives. George Routledge and Sons, London. 289 pp.

Pages 269-282 are titled "On collecting and preserving animals, birds, &c." but gives only basic instructions on preparation along with four recipes for preservatives. One entertaining section is that describing a collecting trip to Honduras where the operator was sadly tormented by mosquitoes and sand flies while attempting to prepare bird skins.

1038 Linnaeus, C. 1753. Latin.

1039 Lloyd, C. 1986. The traveling naturalist, Charles Waterton. Discovery (the magazine of the Yale Peabody Museum of Natural History), 19(2):22-27.

Highly entertaining popular article about this famous 19th century British naturalist. Briefly describes his travels around the world and his taxidermy methods, and contains illustrations of some bird mounts along with his famous "Nondescript" which are currently in the Wakefield Art Gallery and Museum.

1040 Logan, B. M. 1978. Historical taxidermy. Guild of Taxidermists no. 1:5-9.

A history of the origins of preparation and the rise of taxidermy. Told in a storybook manner with no references.

1041 Löwegren, Y. 1978. Swedish.

1042 Lucas, F. A. 1882. A critique on museum specimens. Pp. 34-37, *in* Second Annual Report of the Society of American Taxidermists, 1881-1882. J. J. Whithall, Rochester, New York. 58 pp.

Makes some observations on the usual style of displaying taxidermy mounts in museums and argues that in most cases, the T-perch should be abandoned and specimens be displayed in attitudes illustrating their life styles or behaviors.

1043 **Lucas, F. A. 1884. The scope and needs of taxidermy. Pp. 51-58, *in* Third Annual Report of the Society of American Taxidermists, 1882-1883, Gibson Brothers, Washington, DC. 126 pp.**

Probably the first paper to describe the taxidermist as an artist and compare the work rendered to that of a skilled painter or sculptor. A number of suggestions were offered on how to recreate lifelike attitudes in mounted animals. Lucas may have been the first to suggest making photographs to study positions. Many of the ideas suggested in this article were quickly adopted by American taxidermists and led to the creation of lifelike habitat groups around the turn of the century.

1044 **Lucas, F. A. 1921. The story of museum groups. American Museum of Natural History, Guide Leaflet Series, 53:1-36.**

Presents a very good history of the origins of museum groups, i.e., dioramas. The author lived through much of the period when dioramas were being introduced and built in the United States and knew most of the taxidermists responsible for this innovation. This insight makes the article that much more interesting. Some information is given for the European inventors (Verreaux, Booth, Bullock, etc.), but the bulk of the paper is devoted to American pioneers. With numerous illustrations. This 1921 version was the third printing with some changes in editions. Originally published in The American Museum Journal, 1914, 14(1):1-15 and 14(2):50-65.

1045 **Lucas, F. A. 1927. Akeley as a taxidermist. A chapter in the history of museum methods. Natural History, 27(2):142-152.**

This paper is but one of over ten articles commemorating Carl Akeley in this Akeley memorial number in the Natural History series of the American Museum of Natural History. Other articles describe his contributions to conservation, exploration, sculpting, invention, etc. Lucas describes Akeley's life as a taxidermist, tracing his path from Ward's to Milwaukee, Chicago, and finally New York. Various inventions credited to Akeley by Lucas include the painted background (though this was done much earlier elsewhere), mannikin forms (though this technology was of European origin), and a device for forming artificial leaves.

1046 **Maindron, M. n.d. French.**

1047 **Manesse, D. J. 1786. French.**

1048 **Manton, W. P. 1882. Taxidermy without a teacher, comprising a complete manual of instruction for preparing birds, animals, and fishes with a chapter on hunting and hygiene; instructions for preserving eggs and making skeletons and a number of valuable receipts. Second edition. Lee & Shepard Publishers, Boston. 56 pp.**

Not seen. Citation from Lucas, 1882 (No. 1218).

1049 **Martin, P. L. 1869. German.**

1050 **Martin, P. L. 1870. German.**

1051 **Martin, P. L. 1876. German.**

1052 **Martin, P. L. 1878. German.**

1053 **Martin, P. L., L. Martin, and P. Martin. 1882. German.**

1054 Massaro, M. R. 1988. Systematic collection curators as historic preservationists: case studies from the MCZ mammal and bird departments. Collection Forum, 4(1):16-17.

Discusses some of the specimens at the Museum of Comparative Zoology which houses many of the oldest in North America. Cautions managers of collections to keep good records of older specimens as they may represent extremely valuable historic records of a time long past. Some specimens discussed, held at the Museum of Comparative Zoology, include mounted dolphins from H. A. Ward, golden pheasants once in the possession of G. Washington and mounted by C. W. Peale, and some specimens from the Lewis and Clark Expedition.

1055 Mauduyt, P. 1773. French.

1056 Mawe, J. 1821. The voyagers companion; or shell collector's pilot; with instructions and directions where to find the finest shells; also for preserving the skins of animals; and the best methods of catching and preserving insects, etc., etc., etc. Third edition. Longman, Hurst, Rees, Orme, and Brown, London. xiv + 56 pp.

Very small format book. Chapter IV, pages 35-47, gives directions for preparing specimens of natural history, but is so brief as to be of little use.

1057 Maynard, C. J. 1883. Manual of taxidermy; a complete guide in collecting and preserving birds and mammals. S. E. Cassino and Co., Boston. 111 pp.

Reasonable manual on natural history collections and taxidermy. The majority of the text is devoted to birds (pages 1-83) with short sections on mammals (pages 84-96) and fish (pages 97-101).

1058 Maynard, C. J. 1887. The naturalists guide in collecting and preserving objects of natural history. Second revised edition. Cupples and Hurd, Boston. 115 pp.

Published initially in 1870, again in 1873 (167 pp.), and in 1877 (204 pp.), together with a complete catalogue of the birds of eastern Massachusetts. It appears that pages 1-80 were reprinted directly from the 1870 edition and were undoubtedly the greatest contribution to scientific preparation in the United States up to that time. The manual is well written and contains a good deal of practical advice on collecting and preparation. The appendix (pages 81-115) appears to be a new contribution covering much of the original material but with added improvements found during the interim.

1059 Morris, P. 1981. The antiquity of the Duchess of Richmond's parrot. Museums Journal, 81:153-154.

Describes a method of X raying a taxidermy mount to ascertain the time of preparation. The X ray photograph easily illustrates the mode of preservation and verifies that the Duchess of Richmond's parrot was probably authentic and is the oldest taxidermy specimen in England, mounted circa 1702.

1060 Morris, P. 1986. John Handcock's taxidermy method. Guild of Taxidermists no. 16:10-11.

Reports on the dissection of two owl mounts prepared by John Handcock, one of the leading taxidermists during mid-19th century England. The wiring scheme of Handcock was of his own design and could be useful to authenticate specimens.

1061 Muséum National d'Histoire Naturelle. 1860. French.

1062 Naumann, J. F. 1815. German.

1063 **Nicola, L. 1771. An easy method of preserving subjects in spirits. Transactions of the American Philosophical Society, 1:244-246.**

Reports on two methods of preserving natural history specimens first proposed by Reaumer and offers suggestions for improvements in these methods.

1064 **Nicolas, P. F. 1801. French.**

1065 **Parsons, U. 1831. Directions for making anatomical preparations, formed on the basis of Pole, Marjolin and Breschet, and including the new method of Mr. Swan. Carey and Lea, Philadelphia. xxiv + 316 pp.**

Pages 263-287 give directions for preparing zoological specimens, or parts thereof, in fluid for purposes of anatomical investigation.

1066 **Peale, C. W. 1787. Directions for preserving birds &c. appended to a letter to E. Hazard. *In* Miller, L. B., 1983. The selected papers of Charles Willson Peale and his family. Volume 1. Yale University Press, New Haven, Connecticut.**

Brief directions for skinning birds, probably taken from the works of Reaumer, Kuckhan, and Forster and not improved upon by Peale. Peale was one of the earliest naturalist preparators in the United States and was instrumental in starting the first natural history museum in America.

1067 **Peale, C. W. 1794. Memorandum book dated August 10, 1794. National Portrait Gallery, Smithsonian Institution, Peale-Sellers Papers.**

Describes the recipe for arsenic soap received from Dufresne at the Museum of Natural History in Paris.

1068 **Peale, C. W. 1809. Letter to Stephen Eliott dated February 14, 1809. *In* The collected papers of Charles Willson Peale and his family. (Lillian B. Miller, ed.), Millwood, New York. 1980.**

Describes methods of skinning and mounting birds which was far superior than methods published at the time in English. For small birds, a cork body was fashioned similar to that of the original body, a wire was passed through and wrapped for the neck, and leg wires were inserted, similar to modern methods. Larger birds are done by the wire-stuffing method. For mounting mammals, Peale suggests carving legs out of wood to show all muscles. Also contains Dufresne's recipe for arsenic soap.

1069 **Peale, T. R. 1831. Directions for the preparation and preservation of objects of natural history. Circular of the Philadelphia Museum, 15:4-29.**

Initially reviews the history and holdings of the Philadelphia museum founded by Charles Willson Peale and then provides good details on the preparation of mammals and birds. Summary details are also given for fish, reptiles, insects, crustaceans, worms, shells, starfish, sea-eggs, plants, seeds, and minerals.

1070 **Peck, W. D. 1795. Methods selected from various authors, by Mr. Peck, of preserving animals and their skins. No. V, pp. 10-11, *in* Appendix of Collections of the Massachusetts Historical Society for the Year 1795.**

Lists four different preservation mixtures for skins and the uses of each, but does not credit the authors. The first contains sal ammoniac and corrosive sublimate; the second is made of spirits of wine, turpentine, and camphor; the third is a complex mixture containing arsenic; and the fourth is a spirit solution of corrosive sublimate.

1071 Petiver, J. 1690. Brief directions for the easy making and preserving collection of all natural curiosities. P. 365, *in* James Petiver. Promoter of natural science, circa 1663-1718, (R. P. Stearns), Proceedings of the American Antiquarian Society, 62:243-365.

Not seen. Citation from Williams and Hawks, 1987 (No. 1115).

1072 Pidsley, W. E. H. 1891. Collecting and preserving birds. Birmingham, England.

Not seen. Citation from Browne, 1896 (No. 979).

1073 Piechocki, R. 1982. German.

1074 Pinel, M. 1791. French.

1075 Raimondi, E. 1630. Italian.

1076 Rathbun, S. F. 1884. How to make a good bird skin. Pp. 82-84, *in* Third Annual Report of the Society of American Taxidermists, 1882 - 1883. Gibson Brothers, Washington, DC. 126 pp.

This paper suggests a few minor points which can improve a finished bird skin - -wing placement, proper stuffing, and wrapping of the skin while drying.

1077 Reaumer, R. A. F. 1748. Divers means for preserving from corruption dead birds intended to be sent to remote countries, so that they may arrive there in good condition. Some of the same means may be employed for preserving quadrupeds, reptiles, fishes, and insects (Translated from French by P. H. Zollman). Philosophical Transactions, 45:304-320.

One of the premier papers about the preservation of specimens of natural history. Describes four ways to prepare birds. The first way is to skin the bird and fill the cavity with straw, hay, wood, etc. The second way is to send the specimens in spirit or packed in barrels mixed with chaff of oats or barley, after they have spent an adequate amount of time in spirit. A third way is by filling the body cavity, mouth, and various spots cut into the specimen with preserving powder, effectively making a mummy. The fourth way is to set up the birds and dry them in an oven. Also includes notes for recording data and short recommendations for quadrupeds, fishes, reptiles, and insects.

1078 Ripley, S. D., II. 1961. A cabinet of curiosities. Museum News, 40(3):18-23.

Entertaining popular article discussing the origins of museums in Europe from the beginning of cabinets of natural history through the early 1800s with Charles Willson Peale. Noted contributors discussed include John Tradescant, Elias Ashmole, Ashton Lever, Hans Sloan, and Charles and Rembrandt Peale.

1079 Ritterbush, P. C. 1969. Art and science as influences on the early development of natural history collections. Proceedings of the Biological Society of Washington, 82:561-578.

Discusses many of the very early collections of natural history and how they were related to similar collections of art.

1080 Rosa, V. 1789. Italian.

1081 Rosa, V. 1817. Italian.

1082 Rowley, J. 1898. The art of taxidermy. D. Appleton & Co., New York. 244 pp.

Very good taxidermy manual for its time. Rowley borrowed freely from earlier writers, sometimes giving credit to material taken from Hornaday, M. Browne, etc. Contains an excellent section on artificial vegetation, much improved from the

earlier American works by collaboration with two workers from England who were brought over to the American Museum of Natural History. Reprinted in 1907.

1083 **Rowley, J. 1927. The development of museum taxidermy, part 1. Museum Graphic (Los Angeles Museum), 1(4):121-134.**

Well written paper on the origin of museum taxidermy in the United States and England. Includes photographs of most of the important groups in the history of dioramas in the United States -- fur seal group, 1876, by Stoerzer; Webster's flamingo group; Hornaday's buffalo group, 1889; the robin group at the American Museum of Natural History; etc.

1084 **Rowley, J. 1927. The development of museum taxidermy, part II. Museum Graphic (Los Angeles Museum), 1(5):193-206.**

Details the major accomplishments of museum taxidermy from the 1890s through the publication date. Specifically mentions contributions by Dyche, Chapman, Akeley, the author, Frank Tose, and others. Rowley then gives his own opinions on the status of taxidermy at that time with suggestions for improving its practitioners.

1085 **Schrimper, G. D. 1970. Taxidermy -- past and present. Museum Graphic, 22(1):4-12.**

Extremely entertaining article on the history of taxidermy. Much of the text is about notable American taxidermists and some of the contributions they made to this artform. Those mentioned include Henry Ward, William T. Hornaday, Oliver Davie, and Carl Akeley.

1086 **Scollick, J. W. 1893. On the making of gelatin casts (combs of breeds of fowls). Proceedings of the United States National Museum, 16:61-62.**

Describes the reproduction of soft parts of mounts by casting in a mixture of Irish glue (4 oz), gelatin (2 oz), glycerine (4 oz), and boiled linseed oil (1/4 oz). This technique was an improvement over wax casts, but was ultimately replaced by celluloid (Walters, 1925, No. 878), rubber, fiberglass, etc.

1087 **Shufeldt, R. W. 1894. Scientific taxidermy for museums (based on a study of the United States Government collections). Report of the United States National Museum, 31:369-436.**

Well written description of the history of taxidermy and the status of taxidermy at that time. The first third or so of the text covers the beginnings of taxidermy with numerous quotes from earlier taxidermy texts. The latter portion is devoted to a dialogue on the many photographs of mounts and dioramas contained in the paper.

1088 **Shufeldt, R. W. 1897. Taxidermical methods in the Leyden Museum, Holland. Pp. 1031-1037, *in* Annual Report United States National Museum for 1895.**

Grossly describes the techniques used by the ter Meer family to produce very lifelike mounts of large mammals and birds in the Leyden Museum. Includes 12 illustrations of mounts or mannikins.

1089 **Shufeldt, R. W. 1921. The exhibition series of birds and mammals in the United States National Museum. Museum Work, 3(6):178-185.**

Consists of a rambling review of the United States National Museum collection and the taxidermists who prepared it, describing the quality and accuracy of each specimen. Of historic interest only -- contains no techniques.

1090 **Simpson, G. G. 1942. The first natural history museum in America. Science, 96:261-263.**

Short paper discussing the remaking of natural history collections into museums in America. Suggests the first collections were in Philadelphia prior to 1770 but were not incorporated into an official museum until 1785 by Charles Willson Peale. The earliest museum according to this author was in Charleston, South Carolina, having been founded in 1773.

1091 **Stearns, W. A. 1881. New England bird life, being a manual of New England ornithology. Part 1 -- Oscines. (revised and edited by E. Coues). Fourth edition. Lee and Shepard Publishers, Boston. 328 pp.**

Pages 21-33 address scientific preparation of birds for study. The material is adequate and may be based on that of Maynard, 1870 (No. 1058) or be contributed by Coues, who was well versed in this subject (No. 109) (but who also may have obtained much of his information from Maynard).

1092 **Stollas, M. B. 1752. French.**

1093 **Stradling, Dr. 1883. How to skin, stuff and mount a bird in five minutes. The Boy's Own Paper (London), pp. 331-332.**

Minor paper describing a unique way to skin, stuff with cotton, and pin out a bird skin on a board for display purposes. It is not taxidermy in the truest sense, but simply an ornamental bird skin with spread wings and tail.

1094 **Strix. 1896. A few "don'ts" for amateurs in making bird skins. Oologist, 13(4):27.**

Minor note listing 20 procedures which should not be followed when making a bird skin.

1095 **Swainson, W. 1836. On the natural history and classification of birds. The Cabinet of Natural History Conducted by Rev. D. Lardner, Volume 1. Longman, Rees, Orme, Brown, Green, Longman and Taylor, London. 365 pp.**

A general text on classification and general ornithology. Pages 263-278 give a very thorough treatment on the collection and preparation of scientific study skins, better than many papers of the time. Swainson was well travelled and an acquaintance of John Gould, Audubon, Dufresne, etc., so the information contained in this text was good.

1096 **Swainson, W. 1840. Taxidermy, bibliography, and biography. The Cabinet cyclopaedia conducted by Rev. D. Lardner. Volume CXXVI. Longman, Orme, Brown, Green, Longman and Taylor, London. 392 pp.**

Gives only the basics on taxidermy by this well known naturalist from the early 19th century. Two hundred twenty pages of the work are devoted to biographies of famous naturalists and zoologists. Earlier works on taxidermy and preparation by Swainson were published in 1808, 1820, and 1835, but this 1840 citation is the best known. Reprinted in 1851.

1097 **Sweet, J. M. 1978*a*. William Bullock's collection and the University of Edinburgh, 1819. Annals of Science, 26:23-32.**

Gives some interesting background information on the museum collection of William Bullock gleaned from letters and records surrounding the sale of portions of the collection to the University of Edinburgh and now residing in the Royal Scottish Museum. Bullock formed his museum around 1795 and assembled a collection that rivaled any in the world. It was offered for sale in 1818.

1098 **Sweet, J. M. 1978*b*. The collection of Louis Dufresne (1752-1832). Annals of Science, 26:33-71.**

Interesting account of the collection of Dufresne. Dufresne joined the staff of the Museum d'Histoire Naturelle in Paris in 1793 and soon became known as the best museum taxidermist in the world. Dufresne made public the recipe for arsenic soap (invented by Becoeur) in his taxidermy publication in 1803-04 and also in the second edition between 1816-19, published as a separate in 1820 (see Farber, 1977, No. 1005). Sweet's article discusses Dufresne's life and his ornithological collection which was sold to the University of Edinburgh and is now held in the Royal Scottish Museum.

1099 **Sylvester, S. H. 1865. The taxidermists' manual, giving full instructions in mounting and preserving birds, mammals, insects, fishes, reptiles, skeletons, eggs, &c. Second edition. Published by the author, Middleboro, Massachusetts. 29 pp.**

Abbreviated small booklet describing taxidermy. In essence, it was the first "book" on taxidermy published in the United States, though the information contained therein paled when compared with other earlier works published in Europe. A fourth edition came out in 1874.

1100 **Taylor, J. E. (ed.) 1896. Notes on collecting and preserving natural history objects. Gibbings and Co., London. 215 pp.**

Not seen. Citation from Morris, 1984 (No. 1221).

1101 **Temminck, C. J. 1825. Dutch.**

1102 **Thomson, E. E. 1889. Brief directions for making a bird or mammal skin. Oologist, 6(3):47-48.**

As the title says, the directions are brief. The author does stress that measurements be taken, and sexing and labeling be done properly. Of interest for documentation of methods in use at that time.

1103 **(Turgot, E. T.) 1758. French.**

1104 **Vance, A. 1946. From table with the fringe on top. Frontiers (Academy of Natural Sciences, Philadelphia), 10(3):66-69.**

Entertaining popular article about taxidermy in years past. Much of the information is about Frederick Webster and Henry Ward and their contributions to taxidermy. Illustrations include a stereoscopic view of a fox group and the famous flamingo group of Webster, the Akeley muskrat group, and a drawing by F. A. Lucas of the Ward Natural History Establishment in 1883.

1105 **Violani, C. 1988. Italian.**

1106 **Walker, C. A. 1870. Hints on taxidermy. American Naturalist, 3:136-146,189-201, 481-485.**

Initially covers the basics of preservation formulas, handling specimens, and tools; then goes on to describe the taxidermy procedures for small mammals, large mammals, birds, reptiles, and fish. Good documentation of the techniques used in that time period.

1107 **Ward, R. 1948. Henry A. Ward, museum builder to America. Rochester Historical Society Publication no. 24. Rochester, New York. 297 pp.**

Not seen. Citation from Morris, 1984 (No. 1221).

1108 Warren, B. H. 1896. Taxidermy. How to collect, skin, preserve and mount birds. The Game and Fish Laws of the Commonwealth of Pennsylvania. Department of Agriculture, Division of Economic Zoology, Bulletin, no. 6. 124 pp.

Chapter 1 (pages 14 to 54) provides good details for collecting birds, preparing and labeling scientific specimens, mounting birds, and preparing eggs. The remainder of the text outlines the game and fish laws of Pennsylvania from this era.

1109 Waterton, C. 1828. Wanderings in South America, the north-west of the United States, and the Antilles in the years 1812, 1816, 1820, and 1824. With original instructions for the perfect preservation of birds, etc. for cabinets of natural history. Second edition. B. Fellowes, London. vii + 341 pp.

Pages 321-341 comprise a chapter entitled "On preserving birds for cabinets of natural history". The text is entertaining to say the least, for it is written in a prose-like style containing many philosophical statements. The system used by Waterton for setting up the bird was unique in that he used no wires for support. Though not described here, his mammals were mounted hollow -- filled with sawdust while drying and then drained out. Waterton was the epitome of eccentricity and in general did not get along with other English naturalists, instead becoming bitter enemies with many. In spite of this, Waterton is often considered the father of English taxidermy.

1110 Webster, F. B. 1885-1886. Practical taxidermy. Ornithologist and Oologist, 10:137-139, 153-155, 169, 170, 186-189; 11:3-6, 26-28, 41-43, 57-59, 73, 74, 89, 105-107, 122, 137, 169, 170.

Essentially this is a book-length manuscript which appeared in 15 issues of the *Ornithologist and Oologist*. The text includes recommendations on collecting, preparation tools and supplies, bird skinning and preparation of study skins and mounts, small and large mammal taxidermy, relaxing skins, decorations, and mat making (rugs). The F. B. Webster Company operated for over 40 years supplying study skins, mounts, and naturalist supplies, similar to Ward's Scientific Establishment.

1111 Webster, F. S. 1884. Taxidermy as a decorative art. Pp. 59-67, *in* Third Annual Report of the Society of American Taxidermists, 1882-1883, Gibson Brothers, Washington, DC. 126 pp.

Rambling paper discussing taxidermy as a decorative art. Prior to this article, few taxidermists in the United States attempted to sell their wares as objects of beauty or attempted to use animal parts as functional objects such as fire screens, coat racks, etc.

1112 Whitehead, P. J. P. 1970. Museums in the history of zoology. (Part 1). Museums Journal, 70(2):50-57.

Documents the important role that museums played in the development of zoology as a science. The author divides museum history into six time periods and then proceeds to describe the first four in this article. Discussion is given to contributions of Aristotle, Physiologus, Leonardo da Vinci, Gesner (credited with the first recorded museum devoted largely to natural history, circa 1551-1587), John Ray, Francis Willughby, Olaus Worm, Petiver, Sloane (on whose collection the British Museum (Natural History) was founded), Tradescant, Ashmole, and Seba.

1113 Whitehead, P. J. P. 1971. Museums in the history of zoology. (Part 2). Museums Journal, 70(4):155-160.

Initially discusses the impact made on the whole of science and natural history collections by the Systema Naturae published by Linnaeus. Then continues by discussing the influence museum collections had on zoological science mentioning contributions by Smith (who purchased the collection of Linnaeus and formed the Linnean Society), Buffon, Daubenton, Banks, Hunter, Lever, William Bullock,

Charles Willson Peale, and P. T. Barnum (who brought showmanship to museums, doing much to interest the common man in the wonders of natural history).

1114 **Williams, J. A. 1893. How to prepare a birdskin. Oologist, 10(3):80-81.**

Simple basic instructions on preparation of a bird skin.

1115 **Williams, S. L., and C. A. Hawks. 1987. History of preparation materials used for Recent mammal specimens. Pp. 21-49, *in* Mammal Collection Management, (H. H. Genoways, C. Jones, and O. L. Rossolimo, eds.), Texas Tech University Press, Lubbock, Texas. iv + 219 pp.**

An attempt was made to catalogue all of the materials used during preparation of Recent mammal specimens in the past two centuries. The summary serves as a guide for evaluating the usefulness of specimens for research and also contains a listing of the possible poisons contained therein. The literature section of this paper is a valuable contribution and includes over 170 citations.

1116 **Wonders, K. 1989. Exhibiting fauna -- from spectacle to habitat group. Curator, 32(2):131-156.**

A thoroughly fascinating and well documented paper concerning the history of taxidermy exhibits (primarily in the United States) and their influence on the general public. Includes numerous illustrations and photographs of early habitat groups and an extensive bibliography.

1117 **Woodward, J. (1696). Brief instructions for making observations in all parts of the world. Society for the History of Natural History, reprint 1973 with introduction by V. A. Eyles. 20 pp.**

Not seen. Citation from Morris, 1986 (No. 1222), who says it describes details of collecting specimens in faraway places and sending them back in spirits.

1118 **Young, A. 1847. Instructions on the best mode of collecting, preserving and transporting objects of natural history written by the professors, administrators of the museum of natural history at Paris. Revised by Aaron Young. *In* Report and Resolves of the Legislature of the State of Maine Respecting International Literacy Exchanges, Together with Documents Relating Thereto. By W. T. Johnson, Printer to the State, Augusta, Maine.**

Pages 91-101 describe how to prepare birds and mammals to be sent back to the museum in Paris. In the interest of improving the collections in Paris, a "wish list" was prepared for many of the disciplines.

SEE ALSO

Division XXVI, Bird Exhibits - Design and History.
Hawks and Williams, 1986 (No. 1136).
Löwegren, 1961 (No. 078).

XXXII. MAMMAL PREPARATION AND COLLECTION MANAGEMENT

This section includes publications on mammals specifically with emphasis on preparation. A number of excellent texts have been written on the North American method of preparing traditional round study skins (DeBlase and Martin, 1981, No. 1128; Hall and Kelson, 1959, No. 1135; Nagorsen and Peterson, 1980, No. 1146; Schmidt, 1986, No. 1146) and likewise on the European method of making a flat carded study skin (British Museum, 1968, No. 1126; Brown and Stoddart, 1977, No. 1127; Morris and Wroot, 1987, No. 1145). The preparator should also consult Division II, General Preparation (Anderson, 1965, No. 052; Hangay and Dingley, 1985, No. 067; Piechocki, 1986, No. 082; Wagstaffe and Fidler, 1968, No. 094.)

1119 **Anderson, S. 1961. A new method of preparing lagomorph skins. Journal of Mammalogy, 42(3):409-410.**

Proposes a method of putting up rabbit skins on cotton-wrapped pasteboard cut to the shape of the body. The ears and feet are sewn into the form and wire is placed only in the tail. This new method is faster and requires less storage space.

1120 **Anonymous. 1911. Directions for preserving specimens of large animals. Museum of Vertebrate Zoology, University of California, Berkeley, California. 7 pp.**

Covers the preparation of large animals for purposes of study, including a description of the four standard measurements, labeling, case incision skinning, and recommendations for salting, saving the complete skeleton, and shipping.

1121 **Anonymous. circa 1917. Directions for preparing skins of large mammals from the size of a wolf upwards. American Museum of Natural History, New York. 5 pp.**

Gives basic information on the measurements to be taken from a large mammal prior to skinning so that it may be later mounted. Also describes the cuts necessary for skinning, the proper way to flesh out and salt the skin, and the saving of the leg bones and skull.

1122 **Anonymous. 1931. How to collect and prepare study skins of small mammals. Turtox Service Leaflet no. 40. 4 pp.**

Basic description of collection and preservation of mammal study skins. The system describes leaving the leg bones and the skull in the finished skin and using arsenic or alum as a preservative.

1123 **Anonymous. 1982. Bats. Data, measurements, and preservation. Trustees of National Museums and Monuments of Zimbabwe. 7 pp.**

The pamphlet was designed to provide the collectors with basic information on the data required for specimens of bats (sex, date, locality, habit, habitat breeding data, general notes, mass), the important measurements (overall, tail, hindfoot, ear, forearm, digits three to five, wing length, and wing breadth), and how to prepare fluid specimens. An excellent diagram illustrates the necessary measurements.

1124 **Anthony, H. E. 1931. The capture and preservation of small mammals for study. Third edition. American Museum of Natural History Guide Leaflet no. 61. 54 pp.**

Probably the single most important American publication on scientific mammal collection and preservation in the first half of this century. The second edition was published in 1925 and a reprint of the 1931 version in 1950. Anthony gives excellent information on tools, supplies, collecting by shooting and trapping, measuring and labeling, and skinning and collecting kits. Also describes fluid preservation, saving skeletons, and miscellaneous tips.

1125 **Archer, M., and T. Tebble. 1974. The study of the inner ear of small mammals. Kalori no. 48:51-52.**

Presents a fascinating method of preparation used to study phylogeny of the dasyurids. Casts are made of the complete inner ear by injecting a polyester resin through the oval window, allowing it to set overnight, and then the bone is corroded away with concentrated hydrochloric acid.

1126 **British Museum (Natural History). 1968. Instructions for collectors. No. 1. Mammals (non-marine). Sixth edition. Trustees of the British Museum, London. v + 55 pp.**

Good manual for mammal collectors giving information on collecting by numerous techniques, recording data, skinning and preserving all types and sizes of mammals, wet preservation, and miscellaneous information (parasite collection, photography, hygiene, etc.) The section on actual preparation is small and concentrates on flat skins on cards.

1127 **Brown, J. C., and D. M. Stoddart. 1977. Killing mammals and general post-mortem methods. Mammalogy Review, 7:63-94.**

An unconventional manual containing some material not available elsewhere. No information is given on collecting but over three pages are devoted to "humane" killing. Information is then given on data recording, along with an extensive section on making carded cabinet flat skins of small mammals with photographs and diagrams of the steps involved, and a small section on round skins. An attempt is made to review all methods of skeletal preparation but so little space is devoted to it that it is confusing at best. But it does devote adequate space to problem areas in small skull preparation, though this would be unnecessary if proper methods were used. Also discusses fluid preservation, freeze drying, and has a large section on autopsy.

1128 **DeBlase, A. F., and R. E. Martin. 1981. A manual of mammalogy with keys to families of the world. Second edition. William C. Brown, Dubuque, Iowa. 436 pp.**

Good text on various aspects of mammalogy including sections on skull measuring techniques, tooth form, pelage, information on the basic orders of mammals, age determination, recording data, collecting, specimen preparation and preservation, collecting ectoparasites, etc. The specimen preparation section is a well-written mix of information from most of the important literature. The sections on skinning for tanning and for cleaning skeletal material were contributed by personnel associated with the Field Museum of Natural History.

1129 **Dice, L. R. 1932. Preparation of scientific specimens of mammals in the field. Museum of Zoology, University of Michigan, Circular no. 1. University of Michigan Press, Ann Arbor, Michigan. 10 pp.**

1130 **Dill, H. R. 1968. Preparing small mammal skins for museum collections and classroom use. Museum Graphic, 20(3):7, 12, 15.**

Obviously a "homemade" method for preparation of study skins. Dill did not avail himself of the current literature and evidently invented his own method to imitate the form of a study skin. The method outlined is not recommended because of the materials used in the skin and the amount of time required for preparation.

1131 **Elton, C. 1938. A convenient method of mounting and storing the skins of small mammals. Journal of Mammalogy, 19(2):244-245.**

The initial paper (out of England) on preparation of flat skins of small mammals by casing the skins and attaching them directly on cards cut to size. This system

became the dominant method in England [See British Museum (Natural History), 1968 (No. 1126), and Brown and Stoddart, 1977 (No. 1127)].

1132 **Fisher, C. 1978. User's guide to the mammal collection, National Museum of Natural History. The Smithsonian Institution, Washington, DC. 19 pp.**

Basic description of how to utilize the Smithsonian mammal collections. Well-written information is supplied on access, parking, personnel, location of collections, use of libraries, loans, etc.

1133 **Genoways, H. H., J. R. Choate, E. F. Pembleton, I. F. Greenbaum, and J. W. Bickham. 1976. Systematists, other users, and uses of North American collections of Recent mammals. Museology no. 3, 87 pp.**

Presents the results of a portion of a questionnaire sent to North American systematic collections (565 replies received). The questions dealt with uses of these collections by professional scientists, loan activity, and number of visitors. The type of information sought was listed for a number of larger museums. Appendix One presents a list of systematists who study Recent mammals, while various other appendices provide cross references of this list plus information on loans and uses of the collections.

1134 **Hafner, D. J., J. C. Hafner, and M. S. Hafner. 1984. Skin-plus-skeleton preparation as the standard mammalian museum specimen. Curator, 27(2):141-145.**

Describes a process of mammal preparation similar to the schmoo used in bird skinning where a skin-skeleton is prepared. The left fore and hind feet are prepared in skeleton form. The study skin has only the bones of the right pes and manus and the skeleton lacks only these parts.

1135 **Hall, E. R., and K. R. Kelson. 1959. Suggestions for collecting and preparing study specimens of mammals. Pp. 1036-1047, *in* The mammals of North America. Ronald Press, New York. 1: xxx + 1-546 + 79 pp; 2: viii + 547-1083 + 79 pp.**

An early version of the collection and preparation of mammals section which appeared in Hall, 1962 (No. 066). Most of the text and illustrations were reprinted identically in this later publication with only minor changes and a few additions.

1136 **Hawks, C. A., S. L. Williams, and J. S. Gardner. 1984. The care of tanned skins in mammal research collections. Museology, 6:1-32.**

The definitive work on this subject. No information is given on techniques of tanning but a considerable amount of information is given to storage, environmental conditions, fumigation, conservation, etc. Much of the information would be applicable to taxidermy mounted mammals because they are usually tanned. Contains 85 citations.

1137 **Henshaw, H. W. 1915. Directions for preparing specimens of large mammals in the field. United States Department of Agriculture, Biological Survey Document 102, Washington, DC. 4 pp.**

Gives basic information on field preparation -- measuring, skinning, applying preservatives, drying the skin, preparing the skull, labeling, packing, and shipping.

1138 **Hornaday, W. T. 1886. How to collect mammal skins for purposes of study and for mounting. Pp. 659-670, *in* United States National Museum, Annual Report to the Board of Regents of the Smithsonian Institution for the Year Ended June 30, 1886, Part II, Washington, DC. 842 pp.**

Basic information on preparation of mammal skins (not on collecting). Describes skinning small and large specimens, preservatives, making study skins of mammals, preserving large skins for later mounting, etc.

1139 **Jackson, H. H. T. 1926. The care of museum specimens of Recent mammals. Journal of Mammalogy, 7(2):113-118.**

Probably the first paper dealing exclusively with mammal collection management. Describes the system used by the United States National Museum. Topics include unpacking and care of incoming material, care of specimens during and after preparation, cataloguing, storage of specimens, fumigation, temperature and humidity levels, etc.

1140 **Koestner, E. J. 1941. Modified technique in the preparation of mammal skins. Journal of Mammalogy, 22:315-317.**

Describes an innovative technique of preparing small mammal skins by removal of the body of the specimen through the oral opening, thus eliminating all incisions and stitching.

1141 **Merriam, C. H. 1889. Brief directions for the measurement of small mammals and the preparation of museum skins. Circular of the United States Department of Agriculture, Division of Economic Ornithology and Mammalogy, 11:1-4.**

Minor note by this famous mammalogist. Describes three measurements taken --total length, tail and hind foot length -- and a short section on skinning and preservation materials.

1142 **Miller, G. S., Jr. 1899. Directions for preparing study specimens of small mammals. Bulletin of the United States National Museum, Part N, 39:1-10.**

Basic directions on specimen preparation -- tools and materials, measurements required, skinning and stuffing the specimens, and pinning. Minor mention is made of skeleton preparation and specimens in alcohol and formalin. Revised with new editions coming out in 1901, 1912, 1914, 1925, and the sixth edition in 1932.

1143 **Miller, G. S., Jr. 1928. Mammalogy and the Smithsonian Institution. Annual Report of the Board of Regents of the Smithsonian Institution, 1928:391-411.**

Gives a short history of the evolution of the science of mammalogy in the United States based at the National Museum. Supplies some information on collection management of mammals at that time, complete with illustrations of the Smithsonian collection.

1144 **Moojen, J. 1943. Portuguese.**

1145 **Morris, P., and S. Wroot. 1987. The preparation of mammal skins for scientific, educational and display purposes. Occasional Publication of the Mammal Society, London. 15 pp.**

Excellent publication on the preparation of small mammal skins as flat skins on cards onto which data is written. Numerous other papers give a description of this method first suggested by Elton, 1938 (No. 1131) including the British Museum (Natural History), 1968 (No. 1126), and Brown and Stoddard, 1977 (No. 1127), but they uniformly do not cover the subject thoroughly. The sections on round skins, larger mammals, and skull preparation were so small and disjointed that they are of little use and confuse more than help.

1146 **Nagorsen, D. W., and R. L. Peterson. 1980. Mammal collector's manual. A guide for collecting, documenting, and preparing mammal specimens for scientific research. Life Sciences Miscellaneous Publications, Royal Ontario Museum, Toronto. 79 pp.**

Currently the finest manual on mammal collection and preparation in the world. Provides up-to-date information on almost every aspect of collecting specimens,

recording data in field notebooks and labels, measurements, sex determination (internal and external) and recording reproductive status, locality data, preparing specimens in fluid, traditional and flat study skin preparation, skinning large mammals, preparing skulls and skeletons, karyotyping, miscellaneous collections (parasites, tissue, blood, stomach contents, sperm samples), shipping, and permits. Contains a good bibliography and appendices on collection materials.

1147 **Peterson, R. L. 1965. Collecting bat specimens for scientific purposes. Instructional Leaflet, Department of Mammalogy, Royal Ontario Museum. 8 pp.**

Not seen. Citation from Nagorsen and Peterson, 1980 (No. 1146).

1148 **Rosevear, D. R. 1965. The bats of West Africa. Trustees of the British Museum (Natural History). xvii + 418 pp.**

Pages 370-381 titled "The preservation of specimens" gives a concise description on preparation of study skins, cleaning the skull, and preservation of spirit specimens. The methods outlined are specifically aimed at bats but are applicable for other small mammals.

1149 **Schmidt, R. H. 1986. How to prepare mammal study skins and tan furs. Emporia State Press, Emporia, Kansas. 28 pp.**

Well-written collection of short papers describing mammal preparation. Portions of the text date to 1969. Covers small mammal study skins, specific topics such as cleaning, spoilage, and tools, and a thorough introduction to the basics of tanning.

1150 **Setzer, H. W. 1968. Directions for preserving mammals for museum study. Smithsonian Institution Information Leaflet no. 380. 19 pp.**

Basic description of preparation of mammalian study specimens designed for the amateur naturalist or professional naturalist in another discipline. It provides basic information on tools and supplies, recording data, preparation of study skins of small mammals, skinning large mammals, preserving skeletons and fluid specimens, packing and shipping.

1151 **Smith, D. A. 1968. On the use of tapered tail wires for study skins of small mammals. Journal of Mammalogy, 49(4):787-790.**

Describes the creation and use of tapered wires in tails of small mammal study skins. This system eliminates the need for wrapping the tail wires because the tapered form allows a stronger wire to be used for the base of the tail. Tapered wires are made by dipping monel 400 wire in and out of concentrated acid (3 parts nitric acid and one part hydrochloric acid) until the tips along the first third or so of the wire dissolve in a gradual taper.

1152 **Smithers, R. H. N. 1973. Mammals. The preparation of museum study skins. Trustees of the National Museums and Monuments of Rhodesia, Causeway, Rhodesia. 12 pp.**

Basic description of the procedure used to prepare a scientific mammal study skin of a smaller mammal and a skinned pelt for later tanning for larger mammals. The techniques are similar to North American techniques but many of the preservatives are different (sodium silicofluoride, purified creosote, heavy magnesium carbonate).

1153 **Smithers, R. H. N. 1973. Bats and rodents. Data and measurements. The pinning of study skins. Trustees of the National Museums and Monuments of Rhodesia, Causeway, Rhodesia. 6 pp.**

Gives basic instructions for taking measurements of small rodents and bats, recording other miscellaneous data, and for pinning out specimens to dry.

1154 **Svihla, A., and R. D. Svihla. 1939. Elton's method of preparing mammal skins. Journal of Mammalogy, 20(1):111.**

Reports on the use of the Elton method (No. 1131) of preparing mammals as flat specimens by inserting cardboard in the skinned pelt. Offers some suggestions to improve this method.

1155 **Van Gelder, R. G., and S. Anderson. 1967. An information retrieval system for collections of mammals. Curator, 10(1):32-42.**

One of the earliest papers suggesting that systematic collections be computerized. Reports on a pilot study investigating computerization. Entertaining because of the outdated computer system but the theory is sound.

1156 **Villa-R., B. 1963. Spanish.**

1157 **Walker, A. 1921. Some notes on the preparation of mammal skins. Oologist, 38:166-170.**

Minor paper describing various aspects of mammal collecting and preparation.

1158 **Williams, S. L., R. Laubach, and H. H. Genoways. 1977. A guide to the management of Recent mammal collections. Special Publications, Carnegie Museum of Natural History, 4:1-105.**

Very good guide to collection management of mammals with much of the material relevant to managing other collections. Most of the text is devoted to record keeping (acquisitions, processing, accessioning, cataloguing, loans) and storage (traditional skins, skeletons, fluid specimens, tanned hides). Small sections are devoted to preparation, fumigation, and other miscellaneous methods. Contains a good bibliography and an appendix on the arrangement of Recent mammals at the generic level.

MANUSCRIPTS

1159 **Choate, J. R., R. C. Dowler, and R. B. Wilhelm. 1978. Standardized curatorial procedures for the collection of mammals. Museum of the High Plains, Fort Hays State University, Hays, Kansas. 23 pp.**

A basic manual designed to detail most of the procedures used in curation of routine specimens in the collection of mammals at the Museum of the High Plains.

1160 **Hershkovitz, P. 1954. Collecting and preserving mammals for study: a provisional account for museum personnel and field associates. Chicago Natural History Museum, Chicago. 48 pp.**

Not seen. Citation from P. Staffelen, 1984 (No. 1231), and DeBlase and Martin, 1981 (No. 1128).

1161 **Martin, R. E., and R. L. Packard. 1970. Museum and specimen preparation techniques for collection of mammals, Department of Biology. Texas Tech University, Lubbock, Texas. 21 pp.**

Details field data and specimen tag preparation, specimen preparation, the procedure for curating the collection, and appendices on preparing large mammals and processing skeletal material.

XXXIII. PREPARATION AND COLLECTION MANAGEMENT OF LOWER VERTEBRATES

The majority of papers in this section pertain to preparation and collection management of amphibians and reptiles. Of particular value is the recent publication by Simmons, 1987 (No. 1182). The reader is referred to Division II, General Preparation, and Division V, Fluid Specimen Preparation, for additional relevant information.

1162 Anonymous. n.d. How to preserve reptiles and amphibians for scientific purposes. Museum of Vertebrate Zoology, University of California, Berkeley, California. 2 pp.

Brief directions on preparation of reptiles and amphibians with formaldehyde or alcohol. Includes shipping instructions. Probably published in the 1920s.

1163 Anonymous. n.d. Directions for shipping. American Museum of Natural History, New York. 1 pp.

Directions for shipping live amphibians and reptiles to the American Museum of Natural History. Probably published in the 1920s.

1164 Anonymous. n.d. Suggestions for collecting salamanders. American Museum of Natural History Collector's Leaflet no. 3. 3 pp.

Directions for collecting live salamanders and shipping to the American Museum of Natural History (probably an expanded version of the preceding citation).

1165 Anonymous. n.d. Suggestions to collectors of reptiles and amphibians. American Museum of Natural History Collector's Leaflet no. 2. 4 pp.

Probably published in the 1920s or 30s. Basic instructions for collecting specimens of reptiles and amphibians and preserving in alcohol or formalin.

1166 Anonymous. n.d. Directions for the collection, preservation and dispatch of fish to the National Collection, Queen Victoria Museum, Salisbury. Pp. 46-54, *in* The fishes of Rhodesia. National Museum, Bulawayo.

Provides detailed information on collecting, fixing, preserving, data management, and storage techniques for maintaining fish collections.

1167 Anonymous. 1953. Instructions for collectors no. 3. Reptiles, amphibians and fishes. Sixth edition. British Museum (Natural History), London. 28 pp.

Not seen. Citation from Morris, 1984 (No. 1221).

1168 Bean, J. H. 1881. Directions for collecting and preserving fish. Proceedings of the United States National Museum, 4:235-238.

Early description of preparation and collection management of fish.

1169 Broadley, D. G. 1973. Reptiles and amphibians; instructions for their collection and preservation. Trustees of the National Museums and Monuments of Rhodesia, Causeway, Rhodesia. 5 pp.

Very good concise instructions for collecting, killing, preserving, labeling and recording data on amphibians and reptiles.

1170 Busack, S. D. 1981. Federal regulations regarding the transport of formalin aboard passenger aircraft. Herpetology Review, 12(4):92.

Recommends methods of airplane transport of formalin and reviews United States regulations which lists it in hazard class ORM-A. The fine for not declaring this substance is hefty (if caught) and approval should be obtained prior to arrival at

the airport. If unable to transport it or if formalin is unavailable at the final destination, paraformaldehyde is an adequate substitute.

1171 **Fink, W. L., K. E. Hartel, W. G. Saul, E. M. Koon, and E. O. Wiley. 1978. A report on current supplies and practices used in curation of ichthyological collections. American Society of Ichthyologists and Herpetologists, Smithsonian Institution, Washington, DC. 63 pp.**

A very excellent paper describing the information received from a questionnaire designed to document the curatorial techniques and procedures used in managing an ichthyological collection. Topics discussed include fixatives and preservatives, storage containers, label papers and ink, the collection environment, and data management. Over 50 curators and technicians pooled their knowledge in this report.

1172 **Gloyd, H. K. 1938. Methods of preserving and labeling amphibians and reptiles for scientific study. Turtox News, 16:49-53, 66-67.**

Basic description of preservation of herpetological specimens, written primarily for individuals connected with high schools and colleges.

1173 **Guerra, L. A. 1976. Color preservation in salamanders. Herpetology Review, 7(4):170-171.**

Describes a method purported to maintain color in preserved amphibians, even those stored in light. Specimens are fixed with a solution containing paraformaldehyde and glutaraldehyde buffered with sodium phosphate. The specimens can then be stored in alcohol. After one year, the color had not changed in five species of North American salamanders.

1174 **Karns, D. R. 1986. Field herpetology. Methods for the study of amphibians and reptiles in Minnesota. James Ford Bell Museum of Natural History, Occasional Paper no. 18. 88 pp.**

Chapter four (pages 56-64), entitled "Methods for the Preparation of Herpetological Study Specimens", addresses field data, preserving, labeling, and storage. Much of the rest of the text is devoted to field methods and collecting.

1175 **Kincaid, T. 1948. To preserve the color pattern of the skin in frogs. Turtox News, 26(2):50-51.**

Describes the method of skinning a frog and mounting it on heavy paper similar to the method used by algologists in mounting delicate seaweeds.

1176 **Maslin, T. P., and L. E. Swenson. 1971. A field kit for processing and storing amphibians and reptiles. Journal of Herpetology, 5(3-4):179-181.**

Describes the construction and contents of a well-designed kit for preserving and storing herptiles in the field. Supplies dimensions for duplication as well as an exploded view of the kit.

1177 **Myers, G. S. 1956. Brief directions for preserving and shipping specimens of fishes, amphibians and reptiles. Second edition. Circular of the Natural History Museum, Stanford University, 5:1-3.**

Not seen. Citation from Simmons, 1987 (No. 1182).

1178 **Peden, A. E. 1976. Collecting and preserving fishes. Museum Methods Manual no 3, British Columbia Provincial Museum, Victoria. 24 pp.**

Small pamphlet which provides basic information on collecting fish, fluid preservation, data recording, specimen storage, and a checklist of field equipment.

1179 Pisani, G. R. 1973. A guide to the preservation techniques for amphibians and reptiles. Society for the Study of Amphibians and Reptiles, Herpetological Circular no. 1. 22 pp.

Excellent small booklet discussing field notes, killing and fixing, storage, labeling, and shipment of specimens. Also published in Spanish.

1180 Pisani, G. R., and J. Villa. 1974. Spanish.

1181 Schultz, L. P., and E. A. Lachner. 1956. Directions for collecting, preserving and shipping fishes to the United States National Museum. Smithsonian Institution Leaflet no. 80. 8 pp.

Not seen. Citation from McCain, 1971 (No. 723).

1182 Simmons, J. E. 1987. Herpetological collecting and collections management. Society for the Study of Amphibians and Reptiles Herpetological Circular no. 16. 70 pp.

A tremendously valuable reference. Detailed information is given on field collection, preservation of specimens, and especially collection management, which occupies most of the text. Pages 57-70 consist of an extensive bibliography (in small print) of everything you ever wanted to know about collecting and collection management of herptiles, though there is almost no coverage given to non-English titles.

1183 Slevin, J. R. 1927. The making of a scientific collection of reptiles and amphibians. Proceedings of the California Academy of Sciences, 16:231-259.

For that era, an excellent account of how to collect, prepare, and manage a scientific collection of amphibians and reptiles. Information is given on field equipment, methods of capture, labeling specimens, preservation, cataloguing, and collection management.

1184 Smith, J. L. B. 1968. The collecting and preservation of fishes. South African Museums Association Bulletin, 9(6):202-206.

Details various methods of collecting fish (netting, poisons, explosives, trapping) and preservation in formalin including information on setting (i.e., positioning). Recommends temporary preservation by freezing or, if unavailable, preservation in methylated spirit (75%), boracic powder, or salt.

1185 Stejneger, L. 1891. Directions for collecting reptiles and batrachians. (With supplementary notes giving directions for preserving small herpetological specimens in formalin.) Bulletin of the United States National Museum, 39(Part E):1-13.

Classic paper on collecting, preparing, and maintaining a collection of amphibians and reptiles. Valuable primarily for documentation of techniques used at that date.

1186 Taylor, W. R. 1981. On preservation of color and color patterns. Curation Newsletter no. 3:2-10.

Discusses various factors controlling the preservation of color in fluid specimens (fish, herptiles, crustaceans, etc.) including initial fixation, preserving fluids, light, pigments, oxygen levels in the preserving solution, etc. Gives a thorough review of the literature concerning this problem, as well as some recommendations on methods to attempt to retain as much color as possible.

1187 Wake, D. B., R. G. Zweifel, H. C. Dessauer, G. W. Nace, E. R. Pianka, G. B. Rabb, R. Ruibal, J. W. Wright, and G. R. Zug. 1975. Recommendations for the management of herpetological museum collections. Herpetology Review, 6(2):34-36.

A basic outline of recommendations made by a joint committee of the American Association of Ichthyologists and Herpetologists, the Herpetologists League, the

Society for the Study of Amphibians and Reptiles, and the Association of Systematic Collections, concerning collection management and the services provided by collections.

1188 **Zweifel, R. G. 1966. Guidelines for the care of a herpetological collection. Curator, 9:24-35.**

A good discussion of the care and maintenance (collection management) of scientific collections of amphibians and reptiles. No information is given on collection or preparation of specimens. Most of the information detailed is updated in the recent work by Simmons, 1987 (No. 1182).

See Also

McElman, Sulak, and Van Guelpen, 1987 (No. 1220).
Thomas, 1977 (No. 1228).

XXXIV. MATERIALS FOR VERTEBRATE COLLECTIONS

The citations listed below are a compendium of papers on materials used in vertebrate collections -- reviews, suppliers, and research on these materials. Division XVIII, Collection Management and Conservation, and Division XIX, Feather Structure and Conservation, should also be consulted in addition to numerous other divisions in this publication.

1189 Dowler, R. C., and H. H. Genoways. 1976. Supplies and suppliers for vertebrate collections. Museology, 4:1-83.

A very comprehensive list of materials and supplies used by vertebrate research collections, together with the price range and quantity or sizes available. One hundred eighty three suppliers and addresses are cross referenced. Unfortunately, the publication is dated and needs to be replaced.

1190 Horie, C. 1987. Materials for conservation. Butterworths, London. 9 + 281 pp.

1191 Jannett, F. J. 1989. Some tests of synthetic paper and polyethylene sacks for specimens. Curator, 32(1):24-25.

Reports on two materials not recommended for use in alcohol collections -- the synthetic paper Kindura and small polyethylene envelopes commonly sold in coin shops.

1192 Justice, K. E., and W. J. Schaldach. 1958. Dacron as a filling material for small mammal skins. Journal of Mammalogy, 39(1):158.

Because of difficulty in obtaining good, fluffy, long-staple cotton, the authors experimented with the use of DuPont Dacron batting and found it acceptable for use in study skin preparation.

1193 MacBeth, J. A., and A. C. Strohlein. 1965. The use of adhesives in museums. Museum News Technical Supplement no. 7. 6 pp.

Describes the use of adhesives (glues, gums, pastes, cements, etc.) in natural science and art museums, citing materials to be repaired and the recommended adhesives. Reviews 18 common adhesives in use at that time, and describes 16 formulas for specific instances. Includes a short annotated bibliography on the subject (nine citations).

1194 Ontario Museum Association and Toronto Area Archivists Group. 1985. Museum and Archival Supplies Handbook. Third edition revised. Toronto, Ontario. 174 pp.

Not seen. Citation from Society for the Preservation of Natural History Collections Newsletter, 1(1):3 which describes it as an excellent review of conservation materials, their uses and sources of supply.

1195 Pettitt, C. 1976. Label materials for wet-preserved biological specimens. Museums Journal, 75(4):175-176.

Reports on a test evaluating a new paper, Tyvek, against goatskin parchment and Croxley script. In the tests, Tyvek was considered equal or superior to the other papers, especially for wet-preserved biological specimens.

1196 Ross, G. C. 1961. Labels for biological material. Museums Journal, 61(3):177-179.

Discusses the requirements of good label material for both air and fluid storage. Tests with heat were conducted on white vulcanized fiber which met and surpassed others recommended for air storage. Goatskin parchment paper was the best

available at that time based on tests conducted with various fluid solutions and temperatures. (See also Pettitt, 1976, No. 1195).

1197 **Schur, S. E. 1985. Conservation terminology: a review of past and current nomenclature of materials. Technology and Conservation, 9(1):34-40.**

A very comprehensive list of chemical materials or composites used in science. Listings show the common name prior to the 1800s, during the 1800s, and contemporary name, along with chemical formula and other relevant data. This portion is part one, A through H.

1198 **Schur, S. E. 1985. Conservation terminology: a review of past and current nomenclature of materials. Part II. Technology and Conservation, 9(2):35-38.**

Part two (H through O) of the extensive list from the preceding paper. Presumably concluded in Technology and Conservation, 9(3).

1199 **Williams, S. L., and C. A. Hawks. 1986. Inks for documentation in vertebrate research collections. Curator, 29(2):93-108.**

Excellent paper evaluating 24 varieties of ink used for labels in natural history collections. Various tests or measurements were performed on the inks: pH, corrosiveness, fluidity and opacity, total solids, drying time, color value, lightfastness, and resistance to fluids. The highest-rated ink was Rotring 17 Black, followed by Pelikan 17 Black, Higgens T-100, and Hunt Speedball Super Black India. For specific purposes, some inks were better than those considered best overall.

XXXV. VERTEBRATE RESEARCH COLLECTIONS

This section includes inventories of vertebrate research collections and also general museum directories which sometimes include this information. Reference should also be made to three publications which have inventoried specific portions of bird collections: Wood and Schnell, 1986 (No. 268); Wood, Zusi, and Jenkinson, 1982*b* (No. 301); Kiff and Hough, 1985 (No. 326).

1200 Anonymous. 1975. Museums of the world. Second edition. Verlag Dokumentation, Pullach/München, West Germany. 808 pp.

Not seen. Citation from Genoways and Schlitter, 1981 (No. 1206).

1201 Banks, R. C., M. H. Clench, and J. C. Barlow. 1973. Bird collections in the U.S. and Canada. Auk, 90:136-170.

Presents results of a survey of all known or suspected bird collections in the United States and Canada. Two hundred eighty three institutions or individuals were reported to have study skins, skeletons, mounts, eggs, and nests. Collections were listed by state with data, when available, on size of collection, holotypes, geographic areas, systematic groups, etc. This survey and publication are currently being redone by the Collections Committee of the American Ornithologists' Union.

1202 Choate, J. R., and H. H. Genoways. 1975. Collections of Recent mammals in North America. Journal of Mammalogy, 56(2):452-502.

Fourth version of the survey of Recent mammal collections of North America. Lists 388 collections with current size, types of collections, specialties, etc.

1203 Clench, M. H., R. C. Banks, and J. C. Barlow. 1976. Bird collections in the U.S. and Canada: addenda and corrigenda. Auk, 93:126-129.

Additions and corrections to the earlier list (See Banks, Clench, and Barlow, 1973, No. 1201).

1204 Collette, B. B., and E. A. Lactiner. 1976. Fish collections in the U.S. and Canada. Copeia, 1976(3):625-642.

Results of a five-page questionnaire sent to all fish collections able to be found in North America. Analyzes in detail 39 collections with 20 characters from the questionnaire. Reports at least 35 million specimens of fishes preserved in liquid in the United States and Canada at that time. An appendix gives a complete annotated list of fish collections.

1205 Committee on Resources in Herpetology (David B. Wake, chairman). 1975. Collections of preserved amphibians and reptiles in the United States. Society for the Study of Amphibians and Reptiles (SSAR) Herpetological Circular 3:1-22.

Provides information on more than 100 collections of amphibians and reptiles obtained from responses to questionnaires. The majority of the 3.3 million specimens of herptiles were held at the 20 major collections for which more detailed information is given.

1206 Genoways, H. H., and D. A. Schlitter. 1981. Collections of Recent mammals of the World, exclusive of Canada and the U.S. Annals of Carnegie Museum, 50:47-80.

Reports on a survey of the collections of mammals throughout the world describing 321 collections with more than 50 specimens. Listed by country and specialty geographically and systematically. A similar publication is being prepared for bird collections by the Collections Committee of the American Ornithologists' Union.

1207 **Hudson, K., and A. Nicholls (eds.) 1975. The directory of world museums. Columbia University Press, New York. 864 pp.**

Pages 1-602 are a compilation of hundreds of museums world wide including art, history, and natural history. The remainder of the book is an index of specialized collections. Pages 703 through 714 list those museums dealing at least in part with biology and zoology in natural history.

1208 **Leviton, A. E., R. H. Gibbs, Jr., E. Heal, and C. E. Dawson. 1985. Standards in herpetology and ichthyology: part I. Standard symbolic codes for institutional resource collections in herpetology and ichthyology. Copeia, 1985(3):802-832.**

An excellent paper describing a system of standardization of institutional collections in herpetology and ichthyology. Over 450 institutions worldwide are listed with their official acronyms.

1209 **Muzeelor, R. (ed.) 1971. Directory of the natural sciences museums of the world. Romanian National Committee of ICOM, Bucharest. 380 pp.**

Not seen. Citation from Genoways and Schlitter, 1981 (No. 1206).

1210 **Yates, T. L., W. R. Barber, and D. M. Armstrong. 1987. Survey of North American collections of Recent mammals. Journal of Mammalogy, 68(2, supplement):1-76.**

Most recent survey of Recent mammal collections in North America.

XXXVI. BIBLIOGRAPHIES ON PREPARATION AND COLLECTION MANAGEMENT

Publications listed in this section include general bibliographies which cover information contained in more than one division. Also included are works describing sources of information and literature (Bergman, 1977, No. 1211; Cato, 1988, No. 1212; Stansfield, 1985, No. 1227). Excellent bibliographies are also contained in a number of publications listed elsewhere, especially Piechocki, 1986 (No. 082), and Hangay and Dingley, 1985 (No. 067).

1211 Bergman, E. 1977. Making exhibits -- a reference file. Curator, 20(3):227-237.

A valuable listing of the varied publications and periodicals that apply to the creation of exhibits. References general works and periodicals, and supplies other more specific information on architecture, design, lighting, and preparation.

1212 Cato, P. S. 1988. Review of organizations and resources that serve the needs of natural history collections. Collection Forum, 4(2):51-64.

The author does an excellent job of summarizing many of the institutions, societies, and publications that guide the modern collection manager. By summarizing this information, a partially-trained person has a ready reference for sources of additional literature or dialogue about a particular problem. Lists most of the American and international museum and conservation societies, relevant reports on the various systematic disciplines, and a survey of many of the important periodicals and articles on collection management.

1213 De Borhegyi, S. F., and I. A. Hanson. 1960. A bibliography of museums and museum work 1900-1960. Museology no. 1, Milwaukee Public Museum. 72 pp.

1214 De Borhegyi, S. F., and I. A. Hanson. 1961. A bibliography of museums and museum work 1900-1961. Museology no. 2, Milwaukee Public Museum. 102 pp.

1215 Gütebier, T. mss. Numerous bibliographies on museum preparation, taxidermy, and related activities.

General bibliography of 10 pages with about 225 citations. Book list (taxidermy and museology) before 1900 only -- 13 pages with about 210 citations. Portion on freeze-drying dated 1981 --3 pages with about 65 citations. Preparation and presentation of plants in museum displays dated 1985-86 -- 3 pages with about 75 citations.

1216 Harris, R. H. 1984. A selective bibliography on preservation, macro and micro-anatomical techniques in zoology. Biology Curators Group Report no. 3. 148 pp.

1217 Inskeep, A. 1971. An annotated bibliography for museum technical officers. South African Museums Association Bulletin, 9(17):609-688.

Excellent bibliography covering many aspects of museums, including maintenance, care of specimens, fumigation, field collecting, museum administration, cataloguing, the museum environment, lighting, artwork, exhibit preparation, etc.

1218 Lucas, F. A. 1882. Bibliography of taxidermy. Pp. 47-49, *in* Second Annual Report of the Society of American Taxidermists, 1881-1882, J. J. Withall, Rochester, New York. 58 pp.

Initial American bibliography of taxidermy. Contained only 14 citations. It provided the impetus for the greatly expanded work by McCormick in 1884 (No. 1219) which was later expanded by Montague Brown in 1896 (No. 979).

1219 McCormick, L. M. 1884. Bibliography of taxidermy. Pp. 93-112, *in* Third Annual Report of the Society of American Taxidermists, 1882-1883, Gibson Brothers, Washington, DC. 126 pp.

Probably the most thorough bibliography of taxidermy up to that time, summarizing virtually all of the literature on that subject in America and most of that in Europe. The author was based in Washington, DC, and had access to the Library of Congress and the United State National Museum, and also included citations from Coues, Davie, and an earlier European publication by Englemann, 1846 (No. 1002).

1220 McElman, J. F., K. J. Sulak, and L. Van Guelpen. 1987. References for the preparation of ichthyological specimens. Curation Newsletter no. 9:7-15.

Excellent bibliography including well over a hundred citations. Gross divisions include differential staining of tissues, fixation and/or preservation, preparation of skeletons, histology, etc.

1221 Morris, P. 1984. Taxidermy references: basic list. 13 pp.

Includes over 140 references on taxidermy in Great Britain and America (and a few other European countries). Many of the texts are 19th century. Almost all of these works are in the author's private library, making this one of the most complete collections of books on taxidermy in existence.

1222 Morris, P. 1986. Taxidermy references: supplemental list. 12 pp.

Includes 86 additional citations, with some annotations.

1223 Norton, R., and S. Walston. 1987. Bibliography of works on the conservation of ethnographic materials. ICOM, Paris.

Not seen. Citation found in Society for the Preservation of Natural History Collections Newsletter, 2(2).

1224 Ruhr-Universität Bochum. 1984. Zentralstelle für präparationstechnik. Bibliotheksverzeichnis. Bochum, FRG. 53 pp.

Very complete bibliography from this internationally recognized preparation/taxidermy school. Includes several hundred citations and is extremely comprehensive in the European taxidermy literature. Also includes a list of over 70 serial holdings at the school on pages 47-53.

1225 Shchepanek, M. J. 1981. Appendix A: selected bibliography on care and maintenance of natural history collections. Pp. 185-192, *in* Proceedings of the 1981 Workshop on Care and Maintenance of Natural History Collections (D. J. Faber, ed.), Syllogeus no. 44, National Museums of Canada, Ottawa, Canada. 196 pp.

Short bibliography of papers dealing with collection, preparation, and management of natural history collections.

1226 Spét, J. 1968. Bibliographie Museologica 1818-1967. Kabinet muzejni a vlastivêdná práce prî Národnim muzeu, Prague. 255 pp.

Not seen. Citation from Ruhr-Universität Bochum, 1984 (No. 1224).

1227 Stansfield, G. 1985. A guide to the literature relating to natural history museums. Curator, 28(3):221-226.

A timely publication whose contents have been updated and enlarged by Cato, 1988 (No. 1212).

1228 Thomas, R. A. 1977. Selected bibliography of certain vertebrate techniques. United States Department of the Interior, Bureau of Land Management, Technical Note 306:1-88.

Very comprehensive text including 1240 citations arranged in alphabetic order with an initial subject index referencing over 70 topics. This bibliography includes many citations on collecting specimens, marking and trapping, and censusing.

1229 Williams, S. L., R. Laubach, and C. M. Laubach. 1979. A guide to the literature concerning the management of Recent mammal collections. Museology, 5:1-37.

A very comprehensive text including information on all aspects of collection management with concentration on mammals. Categories include general, philosophies and policies, acquisition, collecting and handling techniques, preservation and preparation techniques, documentation, storage, maintenance, utilization, etc. Includes hundreds of references.

MANUSCRIPTS

1230 Hawks, C. A. 1988. Mercury. Prepared for IMS 1988-89 bibliography, 15 June 1988. 36 pp.

Annotated bibliography of 100 citations describing the use of mercury in preparation of natural history specimens.

1231 Staffelen, P. ms. n.d. Bibliography on collection and preparation of natural history specimens. Leiden Natural History Museum, The Netherlands. 13 pp.

Nice bibliography including approximately 85 citations.

XXXVII. PREPARATION LITERATURE IN LANGUAGES OTHER THAN ENGLISH

DANISH

486 Erritzøe, J. 1983. Könsbestemmelse af fugle. Diorama, 4(3/4):5-13.

A detailed work on sex determination of birds. Also published in German with more technical information and illustrations (No. 487).

374 Erritzøe, J. 1984. Krops- og Halsmaal, saavel som Öjenstörrelse og Farver til Europas Fugle. Diorama, 50 pp (loose-leaf edition).

This is the beginning of a complete catalog of all the birds of Europe listing information on body and neck (via contact sketches), eye size and color, and other pertinent data. Data also given in English. To be continued in upcoming issues of *Diorama*.

1007 Feddersen, A. 1878. Vejledning til at samle og bevare naturgenstande. Second edition. P. G. Philipsens Forlag, Köbenhavn. 106 pp.

General book on taxidermy and preparation of insects and plants with a good description of bird mounting for that time. Important for historical significance.

938 Hjortaa, H. 1968. Präparation - Paraffinering og Indlejrings-präparater - fisk, padder og krybdyr. J. F. Clausens Forlag, Köbenhavn. 132 pp.

General taxidermy manual for fish, and amphibians and reptiles.

713 Hjortaa, H. 1975. Udstopning af fugle og pattedyr. J. F. Clausens Forlag, Köbenhavn. 64 pp.

Good description of bird and mammal mounting.

071 Hvass, H. (ed.) 1942. Natursamleren. J. H. Schultz Forlag, Köbenhavn. 248 pp.

A group of papers on natural history collecting. Includes articles by H. Scheel on bird mounting, photography, sex identification, etc.

658 Knudsen, L. R. 1986. Bevaring af Fjer en undersøgelse af to udstoppede gejrfugle fra zoologiskmuseum. Afgangsopgave kulturhistorisk linie hold VI, København. 153 pp.

A very good paper on conservation of feathers. Discusses numerous aspects including: historically important feathers (Great Auk); storage of specimens; washing, degreasing, effects of chemicals; feather structure, keratin, pigments; fumigation, mothproofing; electron microscopy; etc.

800 Pirtzel, A. 1905. Vejledning i udstopning af fugle og mindre pattedyr (taxidermi). N. C. Roms Forlagsforretning, København. 104 pp.

Nice description of bird mounting, collecting, and collections, though some techniques are outdated. First edition published in 1889.

084 Poulsen, C. M. 1963. Hvordan bevarer man den zoologiske skolesamling. H. Hirschsprungs Forlag, Köbenhavn. 23 pp.

Covers collection and preparation of vertebrates (whole or part) primarily for use in schools.

808 **Scheel, H. 1932. Udstopning af fugle. Hase og Clausens Forlag, Köbenhavn.**

Bird taxidermy. Not seen. Citation from J. Fjeldså and H. Hjortaa.

738 **Scheel, H. 1954. Udstopning af fugle og pattedyr. J. F. Clausens Forlag, Köbenhavn. 54 pp.**

Bird and mammal taxidermy. Not seen. Citation from A. Petersen.

092 **Steenberg, C. M. 1932. Präparation af dyr til skolesamlinger og studiebrug. C. A. Reitzels Forlag, Köbenhavn. 32 pp.**

A short description of how to collect and prepare fluid specimens of vertebrates, primarily for use in schools.

DUTCH

501 **Dutch Birding. 1985. Terminologie voor verenkleed en rui. Dutch Birding, 7(1):1-5.**

Plumage and molt terminology. Compares four publications on this subject and proposes a standardized system.

702 **Eykman, C. 1944. Taxidermie, ten behöve van wetenchappelijke Natuur-historische Collecties. Handleiding voor het maken van balgen en het opzetten van vogels, kleine tot middelmatig groote zoogdieren en koppen van groote zoogdieren met 36 afbeeldingen. Uitgeverij A.A.M. Stols, 'S Gravenhage, Amsterdam. 84 pp.**

Not seen. A later edition was published in 1949 with 107 pages. Citation from P. Staffelen (No. 1231).

1017 **Haar, D. ter. 1898. Handleiding voor den Verzamelaar van Vlinders en voor het opzetten van vogels en zoogdieren gevolgd door eene alphabetische lijst van alle soorten met de synonienmen, die voorkomen in De vlinders van Nederland, systematisch beschreven door P.C.T. Snellen. Met een voorbericht van den Heer P.C.T. Snellen (N.B. in oorspronkelijke band). W. Versluys, Amsterdam. 201 pp.**

Not seen. Citation from P. Staffelen (No. 1231).

081 **Nes, J. G. Th. van. 1952. Preparen methoden voor het preparen van allerlei planten en dieren. Thieme, Zutphen, Holland. 126 pp.**

General preparation of specimens. Republished in 1975 with 146 pages. Not seen. Citation from P. Staffelen (No. 1231).

1101 **Temminck, C. J. 1825. Voorschrift hödanig te handelen met voorwerpen van Natuurlijke Historie, ten einde behoorlijk te verzenden en voor bederf ten bewaren: ten gebruike van het s. Rijksmuseum van Natuurlijke Historie te Leyden. 28 pp.**

Classic work by one of the leading European naturalists of that time.

FRENCH

057 **Blanchon, H.-L. A. 1910. L'art de Conserver et de Naturaliser les Animaux (Vertébrés et Insectes) et d'Utiliser leurs Dépouilles (Fourrures, Plumes, etc.). Garnier Frères, Paris. 391 pp.**

Excellent book (for that time) on natural history collecting with a large section on birds and feathers (pp. 24-119). Citation from C. Weber.

973 **Boitard, M. 1859. Noveau Manuel Complet du Naturaliste Préparateur ou l'art d'empailler les animaux, de conserver les végétaux et les minéraux, de préparer les pièces d'anatomie normale et pathologique; suivi d'un traité des embaumements. A La Librairie Encyclopédique de Roret, Paris. 498 pp.**

Excellent book on natural history collecting for that era. Pages 157-256 on birds. Citation from C. Weber. The first work by this author was in 1821 and another version in 1825, which was translated into German by T. Thon in 1827 titled Hanbuch, für naturaliensammlungen ... Weimar. The third edition of this original work was published in 1835 with 306 pages.

974 **Boitard, M. 1881. Noveau manuel complet du Naturaliste préparateur. Deuxième partie Taxidermie. Préparation des Pièces anatomiques contenaut L'Art d'empailler et de conserver les animaux vertébrés et invertébrés; de préparer les végétaux et les minéraux de faire les préparations anatomiques, de conserver les cadavres temporairement ou définitivement. Nouvell Édition entièrement refondue et complete Par M. P. Maigne. A la Librairie encyclopédique de Roret, Paris. 420 pp.**

Later edition of preceding citation (No. 973) which was printed again in 1910 with the same number of pages. Citation from P. Staffelen (No. 1231).

058 **Bourlière, F. 1941. Formulaire Technique du Zoologiste préparateur et voyageur. Ce qu'il faut savoir pour l'observation, la récolte, la préparation, les élevages. Guides techniques du Naturaliste, Vol. I. P. Lechevalier, Paris. 182 pp.**

General preparation technique book. Pages 92-116 deal with preparation and conservation of vertebrates. Citation from C. Weber.

985 **Capus, G. 1879. Guide du Naturaliste Préparateur et du Naturaliste Collectionneur pour la recherche, la chasse, la récolte, le transport, l'empaillage, le montage, et la conservation des animaux, végétaux, minéraux et fossiles. Librairie J.-B. Baillière et Fils, Paris. 344 pp.**

Good general text for natural history collecting. Other editions in 1883 and 1903.

986 **Capus, G., and A. T. Rochebrune. 1883. Guide du Naturaliste Préparateur et du Voyageur Scientifique. J. B. Baillière et Fils, Paris. 324 pp.**

Not seen. Presumably similar to above. Citation from Ruhr-Universität Bochum, 1984 (No. 1224).

991 **Daudin, F. M. 1800. Traité élémentaire et complet d'ornithologie, ou histoire naturelle des oiseaux. Tome Premier. Siffrein Bertrandet, Paris. 474 pp.**

Early ornithology text. Pages 439-462 deal with natural history collecting and preparation.

112 **Delacour, J. 1932. Conseils pratiques de taxidermie en campagne. L'Oiseau et la Revue Française d'Ornithologie, 4:656-675.**

Addresses scientific preparation of birds in the field.

699 **Didier, R., and A. Boudarel. 1921. L'art de la taxidermie au XX^{e} siècle. Recueil de technique pratique de taxidermie pour naturalistes professionnels, amateurs et voyageurs. P. Lechevalier, Paris. 77 pp.**

One of the most thorough taxidermy manuals in French, primarily valuable for historical importance. Later editions in 1948 and 1968. Citation from C. Weber.

998 **Dorveaux, P. 1924. Apothicaire à Metz et Taxidermiste Historique de son savon arsenical. Société d'Histoire de la Pharmacie. Paris. 26 pp.**

Important paper for historical methods presumably crediting Bocoeur of Metz with introducing use of arsenic. Not seen. Citation from Ruhr-Universität Bochum, 1984 (No. 1224).

999 Dufresne, L. 1820. Taxidermie, ou l'art de préparer et de conserver la dépouille de tous les animaux, pour les musées, les cabinets d'histoire naturelle, etc. 2nd édition. Déterville, Paris. 102 pp.

Perhaps the finest scientific preparation and taxidermy manual of that time. This work was translated into all the of European languages according to Sweet, 1978*b* (No. 1098).

1002 Engelmann, W. 1846. Bibliotheca Historiconaturali.

Compilation of all books and papers up to that time on natural history. Pages through 19 deal with natural history collecting and taxidermy. Citation from C. Weber.

1003 Evans, P. 1841. L'Art de préparer, monter et conserver les oiseaux suivi de la manière de prendre, préparer et conserver les papillons et autre insectes. G. A. Dentue, Paris.

Second edition published by Chez l'Auteur, Paris, 1850. Citation from P. Staffelen (No. 1231). The 1841 version was translated into German by C. L. Brehm and published in 1842, second edition in 1860.

1022 Hénon, J. L., and J. P. Mouton-Fontenille. 1802. L'art d'empailler les oiseaux, contenant des principes nouveaux et sûrs pour leur conserver leurs formes et leurs attitudes naturelles, avec la méthode de les classer d'après le système de Linné. 2cd édition. Bruyset ainé, Lyon. xvi + 283 pp.

Interesting book on old techniques of mounting birds. A similar book was published by the second author in 1811 containing 171 pages.

721 Larsen, H. 1945. La Taxidermie Moderne. Eléments de la technique pour la préparation et le montage des animaux conseils pour chaseurs, explorateurs et amateurs. Éditions de la Frégate, Genève. 139 pp.

A description on different methods for bird and mammal mounting and big-game taxidermy.

076 Larsen, H. 1948. Taxidermie en campagne. Comment chasser, collectionner et préparer correctement. H. Studer, Genève. 36 pp.

Concise booklet on scientific preparation and taxidermy.

1034 Lecoq, H., and A. Boisduval. 1826. Taxidermie, ensignée en dix leçons, ou art d'empailler les oiseaux, les quadrupèdes, les reptiles, et les poissons; ... Terry, Paris. 184 pp.

Not seen. Citation from Williams and Hawks, 1987 (No. 1115).

1046 Maindron, M. n.d. Le Naturaliste Amateur. Librairie Larousse, Paris. 216 pp.

General text on natural history collecting for botany, zoology, and geology. Pages 49-67 cover ornithology. Not seen. Citation from C. Weber.

1047 Manesse, D. J. 1786. Traité sûr la manière d'empailler et de conserver les animaux, les pelleteries et les laines. Déterville, Paris. 196 pp.

One of the most important books on old methods of animal taxidermy.

1055 Mauduyt, P. J. C. 1773. Lettre a l'auteur de ce journal ou mémoire sur la manière de se procurer les différentes espèces d'animaux, de les préparer & de les envoyer des pays que parcourent les voyageurs. Observation sûr la Physique sûr l'Histoire Naturelle et sûr les Arts, 2:473-513.

Not seen. Citation from Williams and Hawks, 1987 (No. 1115).

1061 **Muséum National d'Histoire Naturelle. 1860. Instruction pour les voyageurs et les employés dans les colonies sûr la manière de recueiller de conserver et d'envoyer les objects d'histoire naturelle. 5th édition. Muséum Impérial d'Histoire Naturelle, Paris. 88 pp.**

Not seen. Citation from Williams and Hawks, 1987 (No. 1115).

1064 **Nicolas, P. F. 1801. Méthode de préparer et conserver les animaux de toutes les classes, pour les cabinets d'histoire naturelle. F. Buisson, Paris. viii + 228 pp.**

One of the most important books on old methods of animal taxidermy.

1074 **Pinel, M. 1791. Sûr les moyens de préparer les quadrupèdes & les oiseaux destinés à former des collections d'histoire-naturelle. Observations sûr la physique, sûr l'Histoire Naturelle et sûr les Artes, 39:138-151.**

Not seen. Citation from Williams and Hawks, 1987 (No. 1115).

803 **Quentin, J. 1937. Notions de taxidermie pratique. L'oiseau et la Revue Française d'Ornithologie, 7:159-169, 594-602.**

Short paper detailing methods of taxidermy which were outdated for this time period.

243 **Roche, J. 1954. Préparation des pièces ostéologues. Mammalia, 18(4):420-422.**

Original paper on the preparation of osteological specimens by the perborate method.

136 **Schouteden, H. 1953. La préparation des oiseaux. Zooleo, 21(VII):63-77.**

This paper describes scientific study skin preparation using much of the information and illustrations from J. P. Chapin's classic work (Chapin, 1923, No. 106).

1092 **Stollas, M. B. 1752. Instructions on the manner of preparing objects of natural history. Paris.**

Not seen. Citation from Browne, 1896 (No. 979).

1103 **(Turgot, E. T.) 1758. Mémoire instructif sûr la manière de rassembler, de préparer, de conserver, et d'envoyer, les diverses curiosités d'histoire naturelle; auquel on à joint un mémoire intitulé: Avis pour le transport par mer, des arbres, des plantes vivaces, des semences, & de diverses autres curiosités d'histoire naturelle. J. M. Bruyset, Paris et Lyon. xvi + 236 pp.**

One of the oldest descriptions on how to collect, preserve, and transport natural history specimens.

GERMAN

955 **Andes, L. E. 1894. Das Conserviren von Thierbälgen. U. Hartlebens-Verlag, Leipzig, Wien. 164 pp.**

Simple booklet on how to stuff birds and mammals for that time.

054 **Bade, E. 1913. Handbuch für Naturaliensammler. Pfennigsdorf, Berlin. 614 pp.**

Classic book on collection and taxidermy methods. An earlier smaller version (202 pages) was published in 1899.

750 **Bäge, L. 1964. Über "aufgelegte" Vögel. Der Falke, 11:203-207.**

This article deals with creating two-dimensional bird-feather pictures with background paintings (bird-mounting without using the skin).

055 **Baer, H. W., and O. Grönke. 1975. Biologische Arbeitstechniken. Aulis Verlag Deubner & Co., KG, Köln. 352 pp.**

Written primarily for high schools and universities. Includes only a short portion on birds. Initially published in 1969.

691 **Bornhalm, D. 1979. Präparieren von Vögeln und Säugetieren. Lehrmeister-Bücherei Nr. 106, Albrecht Philler-Verlag, Minden. 160 pp.**

Very simple booklet on how to mount birds and mammals. For the amateur only.

060 **Brucker, G., R. Flindt, and K. Kunsch. 1979. Biologische Techniken. (Biologische Arbeitsbücher Nr. 28). Quelle & Meyer, Heidelberg. 200 pp.**

Not seen. Citation from J. Fjeldså and H. Hjortaa.

696 **Dahl, F. 1914. Anleitung zum Sammeln und Konservieren von Tieren. Verl. Gustav Fischer, Jena. 147 pp.**

Older book with many good methods on taxidermy. First published in 1904 (59 pages) and later in 1908 (144 pages).

906 **Deutsche Künstlervereinigung der Museumsdermoplastiker (DEUKÜMUS). 1931. Die Dermoplastik. Herausgeber ter-Meer, Leipzig; Glasmacher, Berlin; Schröder, Berlin. 9 pp.**

Deals with different methods of mammal mounting, including big game.

700 **Echsel, H., and M. Racek. 1979. Biologische Präparation. 2. Aufl. Jugend und Volk, Wien und München. 253 pp.**

One of the latest books on taxidermy for amateurs by Austrian taxidermists from Vienna with many new methods. First edition in 1976 with 248 pages.

116 **Eck, S. 1978. Über die Vogelbalgpräparation für wissenschaftliche Studien. Dr. Udo Bährmann, Geburtstag zum 85. Zoologische Abhandlungen, Staatlichen Museum für Tierkunde, Dresden. Band 34. P. vi-xii.**

Good description of how to prepare bird skins for scientific studies together with some information on notable collectors.

487 **Erritzøe, J. 1985. Geschlechts- und Altersbestimmung bei Vögeln. Der Präparator 31(2):81-93.**

Sex determination of birds. Probably the best German article on this matter with many new ideas. Also published in Danish.

118 **Gast, R. 1935. Sammlung und Behandlung von Tierkundlichem Material zur Naturalistischen Aufstellung. Verlag Deutsche Gesellschaft für Kleintier- und Pelztierzucht G.m.b.H. & Co., Leipzig. 36 pp.**

Nice description of older taxidermy techniques by this well-known taxidermist from Hamburg. Pages 19 through 24 describe bird study skin preparation.

423 **Gütebier, T. 1977. Restauration von unansehnlichen Paradiesvogel-Bälgen. Der Präparator, 23(1):20-22.**

The author describes a new method to clean, degrease, and remake old poorly made taxidermy mounts using a Bird of Paradise as an example. The before and after photographs are stunning.

1015 **Gütebier, T. 1978. Die Kunst- und Naturalienkabinette des 17.Jahrhunderts. Der Präparator, 24(4):318-324.**

Describes and illustrates a book published in 1704 listing the natural history collections existing at that time around the world.

867 **Gütebier, T. 1980. Eine Möglichkeit zur künstlichen Erzeugung von Torsionsverwindungen am Vogelpräparat (in Flugdarstellung). Der Präparator, 26:279.**

This short note describes methods used to make mounts of birds in flight more life-like by artificial deformation of their primary tips.

868 **Gütebier, T. 1987. Künstliche Augen aus der Betrachtung der historischen Zeitfolge. Der Präparator, 33:121-123.**

The most recent publication about the history of glass eyes in taxidermy mounts.

939 **Hutterer-Niedereder, A. 1978. Das grosse Präparierbuch der Fische. Paul Parey, Hamburg u Berlin. 123 pp.**

Well-written book on mounting fish for trophies using the original skin (not a cast reproduction). An earlier edition was published in 1976 with 118 pages.

1232 **Kalbhenn, P. n.d. Anleitung Vögel auszustopfen und zu konservieren. Verlag Die Jagd G.m.b.H., Berlin-Schöneberg, u.a.**

Not seen. Citation from J. Fjeldså and H. Hjortaa.

919 **Kerz, F., and J. Kerz. 1912. Das Sammeln, Präparieren und Aufstellen der Wirbeltiere. Verlag von Strecker & Schröder, Stuttgart. 148 pp.**

General text important for outlining the Kerz method of modelling mammal mannikins for taxidermy by sewing details into wood wool (excelsior).

403 **Konrad, G. 1969. Konservierung von Vogelbälgen auf Expeditionen - Probleme der Farberhaltung - Präparation für Schausammlungen. Der Präparator, 15:105-116.**

Important publication on collecting and preserving bird skins on an expedition to New Guinea. The skins were transported to Heidelberg in formaldehyde/alcohol solutions.

623 **Lehmann, D. 1964. Die Eulan-Behandlung von Textilien und Zoologischen Präparaten. Pp. 67-72 *in* Arbeitsgemeinschaft des Technischen Museumspersonals. Restaurierung und Konservierung. Bericht von der Tagung in Berlin 1964. Verlag Bruno Hessling, Berlin.**

This paper is from a collection of papers given at a workshop for museum workers and discusses Edolan protection of zoological specimens.

1049 **Martin, P. L. 1869. Taxidermie oder die Lehre vom Konserviren, Präpariren und Naturaliersammeln auf Reisen, Ausstopfen und aufstellen der Thiere, Naturalienhandel, etc. B. F. Voigt, Weimar. 160 pp.**

The first volume of a series of books on taxidermy, natural history, and museology. The author is considered by many to be the father of modern taxidermy in Germany. This particular text is very important for the study of historical methods of animal mounting. A second edition of this classic work was published in 1876 with 216 pages, and a third edition by Martin and sons appeared in 1898 with 163 pages. The text was accompanied by an "atlas" of figures (see Martin, 1976, No. 1051).

1050 **Martin, P. L. 1870. Dermoplastik und Museologie oder das Modelliren der thiere und das aufstellen und Erhalten von Naturaliensammlungen, unter Mitwirkung. B. F. Voigt, Weimar. 240 pp.**

The second volume by this noted author. An expanded second edition was published in 1880 and contained 295 pages. Covers an immense amount of information on modelling all types of mammals, birds, amphibians, fish, etc., and also zoological preparation of vertebrates, etc.

1051 **Martin, P. L. 1876. Atlas zur Praxis der Naturgeschichte. Erster Theil: Taxidermie oder Lehre vom Beobachten, Konserviren, Präpariren und Naturaliensammeln auf Reisen, Ausstopfen und Aufstellen der Thiere etc. B. F. Voigt, Weimar. 14 pp.**

This atlas apparently accompanied all of the volumes written by Martin. I am unaware if the atlas remained unchanged; the only copy I have been able to see is the 1876 version cited above which accompanied the second edition of Taxidermie... (No. 1049). Plate one illustrates common tools, eyes, etc., used by the taxidermist; plate two shows some of the techniques used in mounting birds; plate three depicts pterylosis, bird attitudes, sexing, etc.; and plates four through ten are a collection of excellent sketches drawn by Martin.

1052 **Martin, P. L. 1878. Naturstudien. Die botanischen, zoologischen und Akklimatisationsgärten, Menagerien, Aquarien und Terrarien in ihrer gegenwärtigen Entwickelung, nebst Vorschlägen und Entwürfen für die Anlegung von Naturgärten in kleineren Verhältnissen und grösserer Zentralgärten für Natur- und Völkerkunde. B. F. Voigt, Weimar. i-xii + 1-252 pp.**

This is the first half of the two-part set which accompanies the first two volumes listed above. Much of this portion deals with a survey of botanical gardens, zoos, aquaria, etc. Part of the text deals with certain aspects of preparation and museum collections.

1053 **Martin, P. L., L. Martin, and P. Martin. 1882. Naturstudien. Zweite Hälfte. Allgemeiner Naturschutz; Einbürgerung fremder Thiere und Gesundheitspflege gefangener Säugethiere und Vögel. B. F. Voigt, Weimar. i-xv + 1-210.**

Apparently provides instructions for establishing and controlling accurate habitats for specimens in zoos, botanical gardens, aquaria, etc.

1062 **Naumann J. F. 1815. Taxidermie - oder die Lehre Thiere aller Klassen am einfachsten und zweckmässigsten für Kabinette auszustopfen und aufzubewahren. Hemmerde & Schwetschke, Halle/Salle. 180 pp.**

The most important German book on bird mounting for that time. Includes detailed descriptions of all previous techniques often supplemented by examination of specimens prepared by earlier practitioners. A second edition was published in 1838 and reprinted in 1848.

924 **Pagel, L. 1984. Ältere Gerbmethoden -- aktuell für den Präparator. Der Präparator, 30(4):365-373.**

Presents a history of tanning with description of tools and methods of use. Contains some fascinating older photos. Many of the techniques described are still used today.

799 **Piechocki, R. 1965. Augenkatalog der Vögel Europas. Sonderausgabe Nr. 1 der Zeitschrift für Museumstechnik "Der Präparator", Bonn. 71 pp.**

A catalog of the eyesize and color of European birds. Includes scientific name and regional/country common names (North America, Russia, France, Europe, etc.). Second edition published 1979 in Bochum.

1073 **Piechocki, R. 1982. Über die Geschichte der Präparation von Vögeln. Der Falke, 29(4):114-122.**

Nice summary on the history of bird mounting.

082 **Piechocki, R. 1986. Makroskopische Präparationstechnik. Leitfaden für das Sammeln, Präparieren und Konservieren. Teil 1. Wirbeltiere. 4. Auflage. Gustav Fischer Verlag, Jena. 399 pp.**

Probably the most important book in the world on modern scientific preparation techniques. A general text covering all phases of museum work -- collection, preparation, collection management, etc., primarily used in Germany by the

universities and museums. Earlier editions were published in 1961, 1971, and 1979. Includes a very extensive bibliography.

034 **Porkert, J., and M. Grosseova. 1985. Zur Verantwortung des Präparators am Forschungs- und Unterrichtsgut. Der Präparator, 31:17-19.**

The author points out the responsibility of the preparator to be familiar with current research and information on material used in preparation. He describes two cases where familiarization with literature or materials would have had different and successful results.

739 **Schröder, G. 1936. Das Sammeln, Konservieren und Aufstellen von Wirbeltieren. Leitfaden für Sammler, Liebhaber u. Fachleute nach neuzeitlichen Gesichtspunkten. P. Parey, Berlin. 100 pp.**

One of the most important German books on taxidermy. Describes some innovative dermoplastic methods still in use today.

360 **Schultze, O. 1897. Über Herstellung und Conservirung durchsichtigen Embryonen zum Stadium der Skeletbildung. Anatomischer Anzeiger, 13:3-5.**

First formulated the technique of clearing specimens using potassium hydroxide and glycerine. Later modifications in 1905 introduced the Alizarin stain. Together these provided the basis for all clearing and staining techniques.

740 **Selmons, M. 1907. Handbuch für Naturaliensammler. Ausstopgen von Tieren und die Herstellung von Bälgen. Band 1. Verlag von Ernst A. Böttcher, Berlin. 84 pp.**

Excellent book on taxidermy and sculpture for that time. Third edition printed in 1925.

088 **Selmons, M. 1911. Handbuch für Naturaliensammler. Das Konservieren in Flüssigkeiten und das Skelettieren (Anatomie Zootomie und Skeletopö). Band 2. Verlag von Ernst A. Böttcher, Berlin.**

An old book on taxidermy with many good and unique formulas for preservation of specimens for that time.

814 **Septon, G. 1987. Das Aufstellen alter Vogelbalge. Der Präparator, 33(4):157-166.**

Not seen. English translation: The mounting of old bird study skins.

741 **Stehli, G. 1969. Sammeln und Präparieren von Tieren. 5. Aufl. Franckh'sche Verlagshandlung, Stuttgart. 142 pp.**

One of the few recent books in German, unfortunately out of print. Used the same photographs as in G. Schröder, 1936 (No. 739). Other editions 1936 (100 pages), 1953 (136 pages), and 1959 (144 pages).

743 **Thorns, H.-J. 1981. Sammeln und Präparieren von Tieren. Franckh, Stuttgart. 144 pp.**

One of the very few modern German books about taxidermy. The techniques are well presented but the illustrated mounts are very poor. The book is for amateurs only.

534 **Winkler, R. 1979. Zur Pneumatisation des Schädeldachs der Vögel. Ornithologische Beobachter, 76:49-118.**

The best paper at present addressing the subject of pneumatization in most groups of birds. Contains an English summary with figure legends in English and German.

Manuscripts

1016 Gütebier, T. 1989. von Hohberg's Georgica Curiosa (1682) - Über einen wiedergefundenen Quellennachweis zum Studium der Geschichte der Präparation. 4 pp.

Describes this historic work by von Hohberg, which may be the oldest book detailing taxidermy as we know it today. The method given for bird mounting is not that different from some techniques used today. Also mentions use of arsenic, predating Becouer by close to 100 years.

HUNGARIAN

320 Horvath, L. 1957. Az oologia, mint tudomanyos kutatas. Aquila, 63-64:111-118.

English translation: Oology -- a scientific research.

070 Horvath, L. 1962. Pp. 377-390, *in* Az állatok gyújtése (L. Móczár, ed.), Gondolat, Budapest. 490 pp.

General text on scientific collecting and taxidermy.

ITALIAN

The Italian section was compiled and annotated by Carlo Violani of the Universita de Pavia.

956 Anonymous. [G. B. V.]. 1788. [Review of] Traité ec. Trattato intorno al modo di impagliare e conservare gli animali, le pelli e le lane, dell'Abate Manesse (...). Biblioteca Oltremontana ad Uso d'Italia, Torino, 1:11-25.

The anonymous author (the article is signed "G. B. V."), while reviewing the Abbé Manesse's "Traité" (1787), quotes extensively the taxidermic methods used by Michele Spirito Giorna (1741-1809). Giorna explains in detail his own preparation techniques of birds: collages of feathers pasted onto cardboard and mounted as pictures, which saves a considerable amount of space, for a natural history museum.

695 Cova, C. 1969. Manuale di imbalsamazione Mammiferi, Uccelli, Rettili, Anfibi e Pesci. Ulrico Hoepli, Milano, 186 pp.

The third edition of this book was published in 1979. A practical handbook for vertebrate taxidermy, from mammals to fish, with brief hints on skeleton preparation, and egg and nest collections. It relies mainly on Gestro's traditional methods.

1001 Eger, L., and M. Lessona. 1885. Il raccoglitore naturalista. Guida pratica per raccogliere, preparare, conservare i corpi naturali organici e inorganici. Second edition. Ermanno Loescher, Torino. 124 pp.

The first edition of this popular translation from the German by M. Lessona was published in 1877. A general booklet for the collection and preservation of animals, plants, and minerals. There are hints on bird preparation, but very few figures.

706 Gestro, R. 1915. Il naturalista preparatore (imbalsamatore - tassidermista). Ulrico Hoepli, Milano, i-xv + 1-214.

The first edition of this book was published in 1882 under the title "Manuale dell'Imbalsamatore (Preparatore Tassidermista)", and a sixth edition in 1925. The best historical handbook of taxidermy in Italian. Contains notes on vertebrates and invertebrates, their preparation and preservation. It gives methods for skinning,

sexing and mounting birds, as well as suggestions for spirit, skeletal and oological collections. Also methods for the transportation of naturalistic material.

065 **Gestro, R., and D. Vinciguerra. 1926. Il Naturalista viaggiatore. Second edition. Ulrica Hoepli, Milano. 204 pp.**

A classical handbook for travellers, especially in foreign countries, interested in natural sciences. Chapter 3 (pp. 27-44) is devoted to the collection and preparation of birds for taxidermic purposes, and also gives information on collections of nests, eggs, and skeletal material.

709 **Guerra, M. 1978. Preparazione tassidermica di grandi uccelli con ricupero dello scheletro per preparati osteologici. Rivista Italiana di Ornitologia, Milano, 48:243-245.**

An article on the preparation of large birds (ostrich, cassowary) with recovery of the whole skeleton for osteological preparations.

1027 **Issel, A., and R. Gestro. 1880. Istruzioni per fare le raccolte e le osservazioni zoologiche.** ***In*** **(A. Issel) "Istruzioni scientifiche pei Viaggiatori", Tipografia Eredi Botta, Roma. 75 pp.**

A useful handbook of instructions for collecting zoological materials. Chapter 2 is devoted to birds: collecting, skinning, labelling, sexing, stuffing birds and their preservation against insect pests. Includes recipes of arsenical soap. Republished in 1883 as "Manuale del Naturalista viaggiatore" through Ulrico Hoepli, Milano.

792 **Marchetti, S. 1969. L'arte della tassidermia. Volume Primo. Uccelli. Editoriale Olimpia, Firenze. 187 pp.**

A recent handbook devoted to birds, still in use among Italian taxidermists. Contains useful photos in black and white showing the different steps in preparing bird skins. Also gives a list of Italian bird species with their eye colors. The color plates show mounted bird specimens in attractive natural postures.

804 **Ragionieri, R. 1961. Imbalsamazione degli Uccelli. Second edition. Editoriale Olimpia, Firenze. 178 pp.**

A classic handbook on bird taxidermy, first published in 1952, also with notes on preservation of eggs and nests, preparations of skins, mounting and restoration of bird specimens. Mainly intended for commercial taxidermy. Includes a curious appendix on the different categories of the palatability of Italian birds.

1075 **Raimondi, E. 1630. Delle Caccie Libri quattro, aggiuntovi in questa nuova impressione altre Caccie che sperse in altri libri andavano. Venezia.**

A classic text of hunting and bird-keeping of the seventeenth century. Contains a paragraph on the techniques for the preservation of bird skins for ornamental purposes or for lining clothes. The bird skin was treated with a mixture of flour glue, salt, and "good white wine", absinth, or other odoriferous substances.

806 **Roncagliolo, G. B. 1915. L'imbalsamazione degli Uccelli esposta con metodi facili. Giornale degli Allevatori, Catania. 55 pp.**

A booklet with some photos of birds mounted in small biological groups. The text is mainly inspired from Gestro, 1915 (No. 706).

1080 **Rosa, V. 1789. Metodo di preparare e conservare gli Uccelli per i Gabinetti di Storia Naturale. Pietro Galeazzi, Pavia. i-vii, 1-30.**

The author was the taxidermist of the Zoology Museum of the University of Pavia. The work is dedicated to Maria Amalia, duchess of Parma, Piacenza e Guastalla, and

was also placed under the patronage of her son, the future duke of Parma, who "amuses himself in stuffing birds with admirable results".

The author explains his own methods for skinning, mounting, and preserving bird specimens against dermestids and other insect pests, suggesting powdered arsenic or corrosive sublimate diluted in wine spirit. He recommends one observe birds in life in order to prepare them as lifelike as possible, with the most natural and picturesque attitude, according to each bird's character. "Under a single bell glass many birds could be grouped together perching on small branches and arranged as they were about to perform a sort of 'historical action' [*sic*]".

1081 Rosa, V. 1817. Metodo di preparare e conservare gli Animali per un Gabinetti di Storia Naturale. Pietro Galeazzi, Pavia.

Includes general methods for preparing mammals, birds (reprinted almost identically from the previous book), amphibians, reptiles, fish, and insects. The author also gives suggestions concerning the arrangements of shelves and cabinets for museum exhibits.

1105 Violani, C. 1988. Un bestiario barocco. Quadri di piume del Seicento milanese. Museo Civico di Storia Naturale di Milano. 126 pp.

The complete catalogue of Minaggio's feather pictures, now preserved at the Blacker-Wood Library of Biology, McGill University, Montreal, Canada. It is the oldest known collection of bird skins representing northern Italian birds, pasted with their original bills and feet onto paper sheets. The plumage of the body has been carefully recomposed as a feather collage. The author, D. Minaggio, who lived in Milan at the beginning of the seventeenth century, signed this extraordinary work in 1618, styling himself as the gardener of the governor of the duchy of Milan.

097 Zangheri, P. 1981. Il naturalista esploratore, raccoglitore, preparatore. Guida pratica elemantare per la raccolta, preparazione, conservazione di tutti gli oggetti di storia naturale (Animali e piante viventi e fossili - Minerali e Rocce). Sixth edition. Ulrico Hoepli, Milano. 503 pp.

This is the last edition (the first was published in 1951) of the most famous and popular handbook created for the "exploring, collecting and preparing Naturalist". There is a whole illustrated chapter on the collecting, preparation, and preservation of birds, with information on nest, egg, and skeleton collections. It includes recipes of taxidermic substances and useful addresses of dealers in natural history objects, as well as a related biliography on the subject of taxidermy. In the last edition a new chapter has been added concerning the creation of a small museum for educational purposes.

LATIN

1038 Linnaeus, C. 1753. Instructio musei rerum naturalium, quam, consensu experient. et nobiliss. L. M. Hojer, Uppsala, iv + 20 pp.

Not seen. Citation from Williams and Hawks, 1987 (No. 1115).

NORWEGIAN

138 Shipues, K. n.d. Behandling av fugl ved de naturhistoriske museer. Museumsnytt 3-84. s. 43.

Not seen. Citation from J. Fjeldså and H. Hjortaa.

045 **Vader, W. 1982. Regionalmuseens rolle i naturvernforskning og utredningsarbeid i Norge. Foredrag Symp, Helsingfors.,11:1-8.**

Not seen. Citation from A. Petersen.

PORTUGUESE

714 **Hjortaa, H. 1978. Taxidermia embalsamento de aves e mamíferos. Editorial Presenca, Portugal.**

Not seen. Citation from J. Fjeldså and H. Hjortaa.

1144 **Moojen, J. 1943. Captura e preparação de pequeños mamíferos para coleções de estudo. Museu Nacional, Rio de Janeiro. 98 pp.**

Not seen. Citation from D. M. Teixeira.

131 **Pinto, O. M. O. 1938. Breves noções sobre a maneira de preparar e conservar as aves. Bol. Biol., 3(2):67-70.**

Not seen. Citation from D. M. Teixeira.

085 **Roquette-Pinto, P. 1938. Historia natural. Livraria Globo, Porto Alegre. 191 pp.**

Not seen. Citation from D. M. Teixeira.

093 **Vanzolini, P. E., and N. Papavero (coordense dores). 1967. Manual de Coleta e Preparaçaõ de Animais Terrestres e de Água Doce. Departamento de Zoologia. Secretaria da Agricultura do Estado de Saõ Paulo, Brazil. Pp. 1-223.**

General text on natural history collecting written by two of the country's leading authorities.

RUSSIAN

929 **Saslavsky, M. A. 1964. [New methods for mounting animals.] Scientific Press. Moskau/Leningrad.**

Covers mammal taxidermy and sculpture.

807 **Saslavsky, M. A. 1966. [Bird preparation - museum study skins, skeletons and taxidermy.] Scientific Press, Moskau. 252 pp.**

An extremely well-written and modern taxidermy text on bird taxidermy including scientific preparation. Some of the techniques are different from those used by North American preparators but the theory and results are identical.

737 **Saslavsky, M. A. 1968. Animal mounting. Scientific Press. Leningrad.**

Covers general taxidermy.

SPANISH

053 **Areny, P. de. n.d. Manual del naturalista preparador. Nuevo tratado teórico-practico para la preparación, disecación, caza y pesca de toda clase de animales, y conservación de plantas, montaje de esqueletos, preparación de fósiles, etc., etc. Sucesores de Manuel Soler, Barcelona & Buenos Aires. 173 pp.**

General preparation text. Chapter 2, pages 84-100, deals with birds. Also covers mammals, reptiles, fish, insects, invertebrates, plants, minerals, and other techniques.

755 **Budin, O. A. 1976. Taxidermia y captura de aves. Ministerio de Cultura y Educación Fundación Miguel Lillo, Tucuman, República Argentina, Miscelánea No. 58. 67 pp.**

Describes collecting specimens, taxidermy using a hummingbird as an example, and information on making a scientific collection.

902 **Budin, O. A. 1982. Taxidermia y captura de mamíferos. Ministerio de Cultura y Educación Fundación Miguel Lillo, Tucuman, República Argentina, Miscelánea No. 73. 35 pp.**

Good information on mammal collecting, taxidermy, and preparation of scientific study specimens with up-to-date information.

061 **Cerda C., J. 1977. Normas para la prospección básica de fauna silvestre. Ministerio del Ambiente y de los Recursos Naturales Renovables, Division Estudios Basicos, Serie Norma, DGIIA, Caracas, Venezuela. 87 pp.**

General text on natural history collecting, including information on field methods, preparing mammals, birds, reptiles, amphibians and osteological material.

062 **Chani, J. M. 1980. Guia de métodos de captura para el estudio de vertebrados. Ed. Universidad Nacional de Mar del Plata, Buenos Aires.**

Not seen. Citation from Budin, 1982 (No. 902).

107 **Chapin, J. P. 1965. Conservación de aves para el estudio. Translation of "The preparation of birds for study" by R. A. Philippi B. Museo Nacional de Historia Natural, Santiago, Chile. Serie Educativa No. 4. 45 pp.**

Direct translation of text from the 1940 version of J. P. Chapin's classic work (1923, No. 106) with some illustrations taken from E. Blake's paper of 1949 (No. 105).

1000 **Duges, A. 1981. Instructions for bird collectors. Centzontle, 1:115-122.**

A reprinted original "how-to" book published in 1892. Not seen.

125 **Mendez, J. L., and S. F. Martin. 1949. Breves apuntes para la colección y clasificación de las aves. Mem. Soc. Cienc. na. la Salle, Caracas, 9:23:41-50.**

726 **Montes, L. M. 1980. Manual de taxidermia. Ed. Albatros, Buenos Aires. 123 pp.**

Not seen. Citation from D. M. Teixeira.

080 **Museo Ecuatoriano de Ciencias Naturales. 1983. Tecnicas de Campo y Laboratorio. Memorias. De los cursos-taller de tecnias de recolección, etiquetación, preservatión y exhibición de especies naturales para museos de ciencias naturales. Museo Ecuatoriano de Ciencias Naturales, Serie: Misceláneas. Ano 4, No. 2, 148 pp.**

Memorial volume on field and laboratory techniques in the natural sciences. Pages 77-88 on birds. Not seen. Citation from C. Weber.

1180 **Pisani, G. R., and J. Villa. 1974. Guía de Tecnicas de Preservación de Anfibios y Reptiles. Society for the Study of Amphibians and Reptiles, Herpetological Circular no. 2. 28 pp.**

087 **Schlater, R. P. 1973. Guía para la prospección básica de fauna en Parques Nacionales. Corporación Nacional Forestal. Chile.**

Not seen. Citation from Cerda, 1977 (No. 061).

137 **Serié, P. 1918. Nociónes sobre preparación y conservación de aves. El Honero, 1(3):168-177.**

Older paper describing the scientific preparation of birds.

815 **Serié, P. 1936. Nociónes de taxidermia el montaje de aves. El Honero, 6:271-279.**

Short paper describing taxidermy using methods outdated at that time but obtaining good results as judged by the illustrations.

260 **Torres, H. 1972. Instrucciónes para preparar y conservar cráneos de Mamíferos. Hoja Mimeo. Santiago, Chile.**

Not seen. Citation from Cerda, 1977 (No. 061).

821 **Utges, E. E. 1980. Curso practico de taxidermia. Parte 1 - Aves. Notas del Museo No. 22, Museo de Historia Natural, Departamento de San Rafael, Provincia de Mendoza, República Argentina. 36 pp.**

Recent publication with excellent information on bird taxidermy. Some unique methods and materials.

1156 **Villa R., B. 1963. Sugestiónes para preparar en el campo ejemplares para estudio de pequeños mamíferos. Institudo de Biología. Talleries Gráficos de la Nación Mexico, D.F. 45 pp.**

Classic work on mammal preparation by this famous Mexican mammalogist. R. W. Dickerman, who supplied this citation, thought there was a companion bird manual.

SWEDISH

687 **Andersson, G. E. 1970. Preparering av djur. Bonniers, Stockholm. 94 pp.**

A nice little booklet with some new ideas in different mounting techniques. Pages 40-57 detail bird mounting.

424 **Gütebier, T. 1980. Hur man monterar om ett historiskt faagelpreparat. Diorama, 1:15-17.**

The author describes a method to clean, degrease, and remake old, poorly made taxidermy mounts.

576 **Gütebier, T. 1986. Klimat och ljus; Naturhistoriska museers utställningar och magasin. Diorama, 6(2):36-41.**

The author discusses the common problems with relative humidity and lighting which can cause deterioration of specimens in natural history museums. In two parts.

577 **Gütebier, T. 1987. Klimat och ljus; Naturhistoriska museers utställningar och magasin. Del. 2. Diorama, 7(1):1-7.**

Part two of above citation. Suggests methods of reducing damage to specimens which are a result of humidity and light.

917 **Hegenauer, H. 1982. Garvningsteknik för konservatorn. Diorama, 3(3/4):27-41.**

Probably the most important summary of the various German tanning techniques for animal mounting.

077 **Löwegren, Y. 1939. Biologisk Teknik. Svensk Uppslagsbook. Malmö. 447 pp.**

Early work by this noted author. Replaced by Löwegren, 1961 (No. 078).

1233 **Löwegren, Y. 1946. Vaara ryggradsdjur - hur man preparerar dem. Albert Bonniers Förlag, Stockholm. 95 pp.**

078 **Löwegren, Y. 1961. Zoologisk museiteknik. Djurens Värld, Volume 15 (B. Hanström, ed.). Forlagshuset Norden AB, Malmö, Sweden. 551 pp.**

One of the most important books in the world on modern scientific preparation techniques, the most important in Scandinavia. Details all aspects of scientific preparation and taxidermy. The chapter on the history of taxidermy and collecting is the best rendering of this subject in print. Third edition published in 1972.

1041 **Löwegren, Y. 1978. Forna tiders djurkonservering. Särtryck ur Malmö Museums årsbok. 32 pp.**

A nice booklet on the history of museum collection and preparation techniques in older days. Contains many figures with captions in English and Swedish and a two-page English summary.

791 **Lundström, L. 1986. Faagelmontering enligt J. Snellman - "Skelettmetoden." Diorama, 6(2):25-35.**

Description of the world-famous method of mounting birds developed by J. Snellman. Much of the skeleton is used in building anatomy into the mannikin. Describes the use of a modeling material made from cork powder and a rubber solution that is placed directly under certain feather tracts and allows for precise feather grooming.

923 **Pagel, L. 1983. Äldre garvningsmetoder - ännu aktuella för konservatorn. Diorama, 4(1/2):9-20.**

Presents a history of tanning with description of tools and methods of use. Contains some fascinating older photos. Many of the techniques described are still used.

813 **Septon, G. 1982. Ett satt att astadkoma naturtrogna kammar till vilda honsfagler. Diorama, 3(1/2):1-3.**

English translation: Comb reproductions for European grouse.

438 **Septon, G. 1983. Fageltvatt a la Septon. Diorama, 4(3/4):3-4.**

English translation: Washing bird skins.

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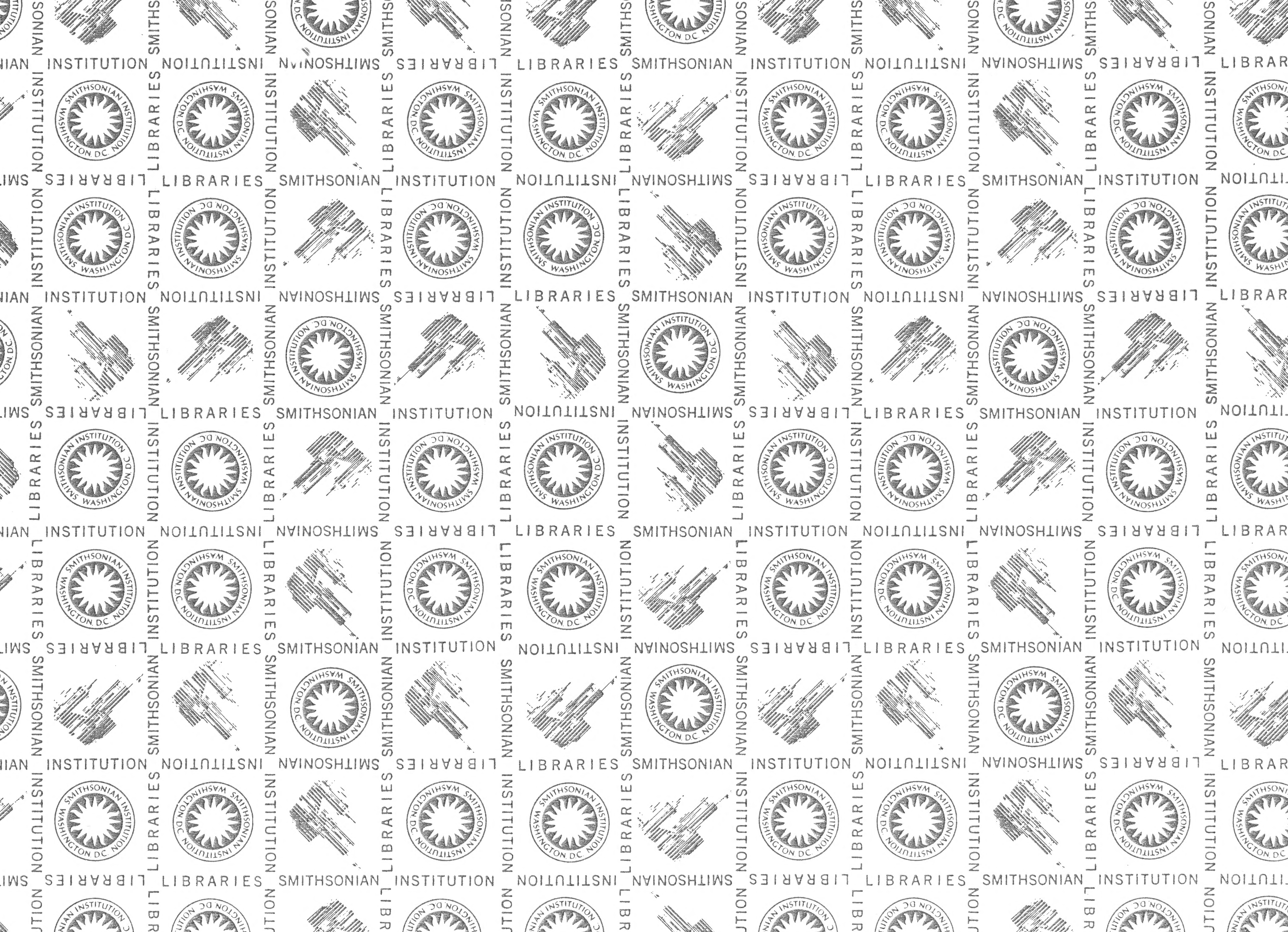
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